

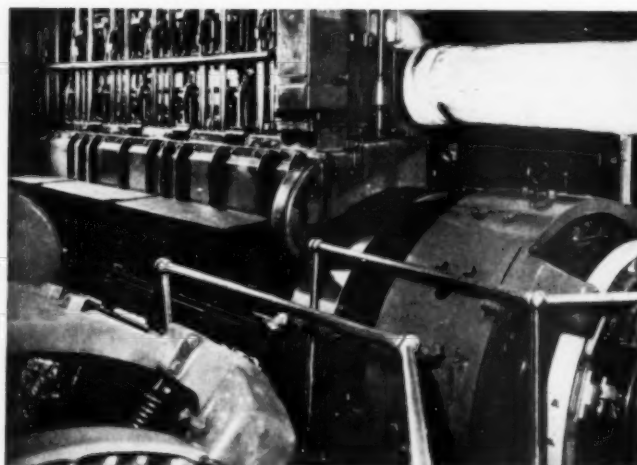
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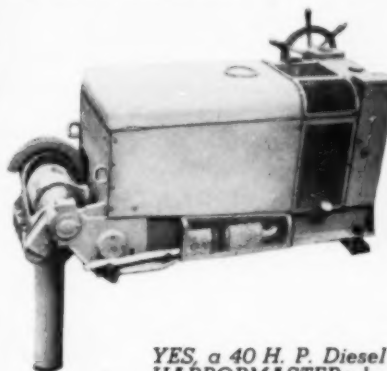
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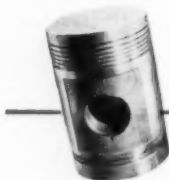
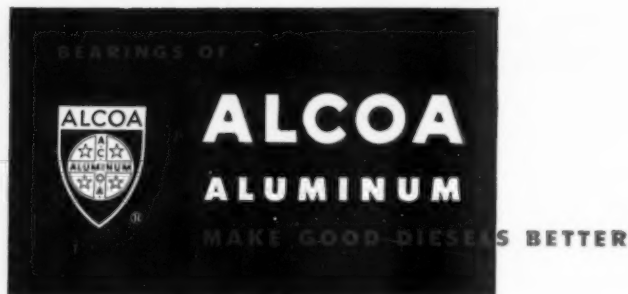
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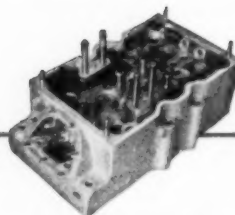
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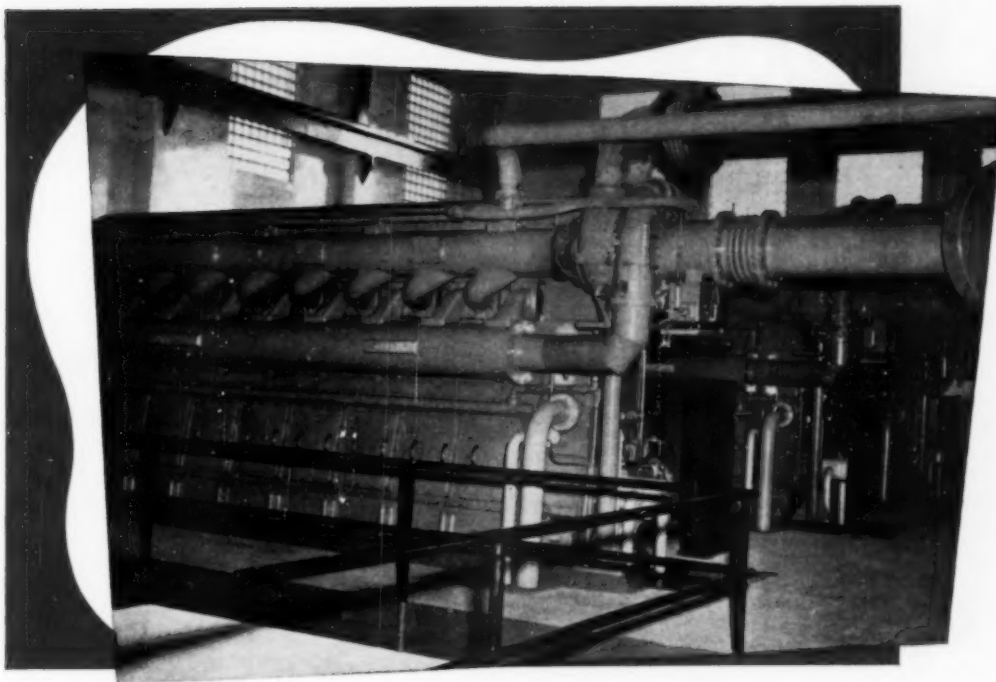


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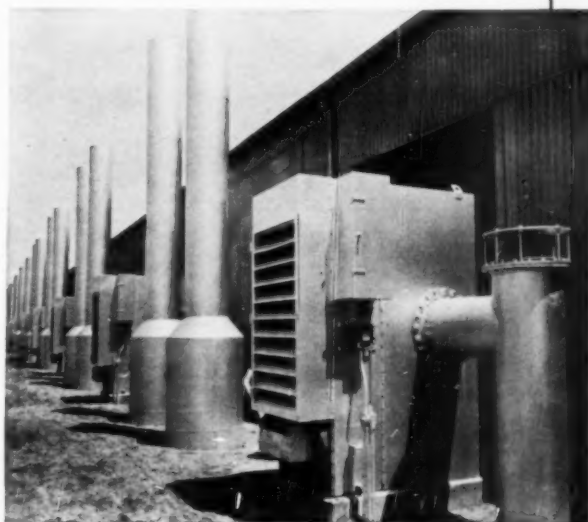
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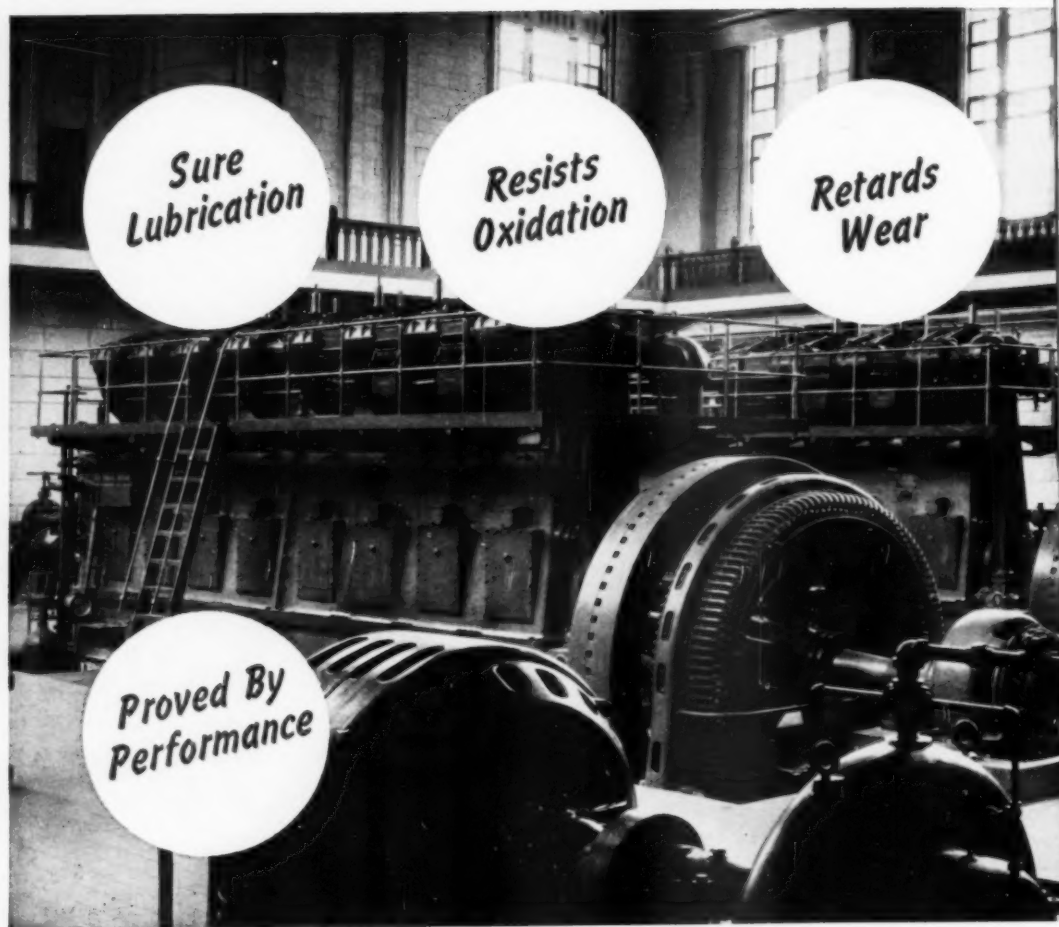
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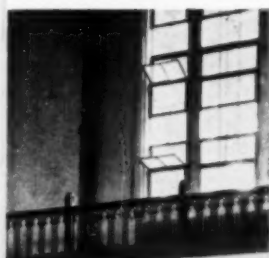
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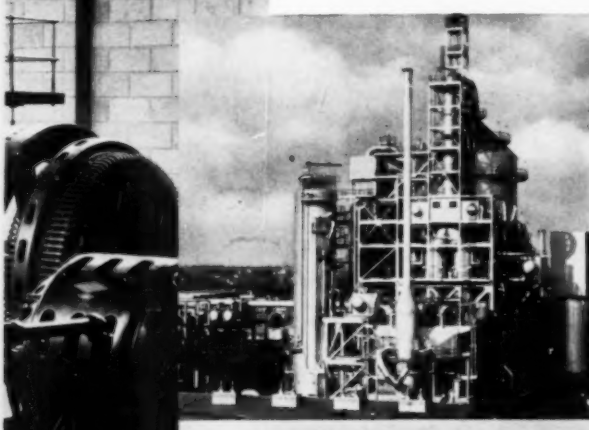
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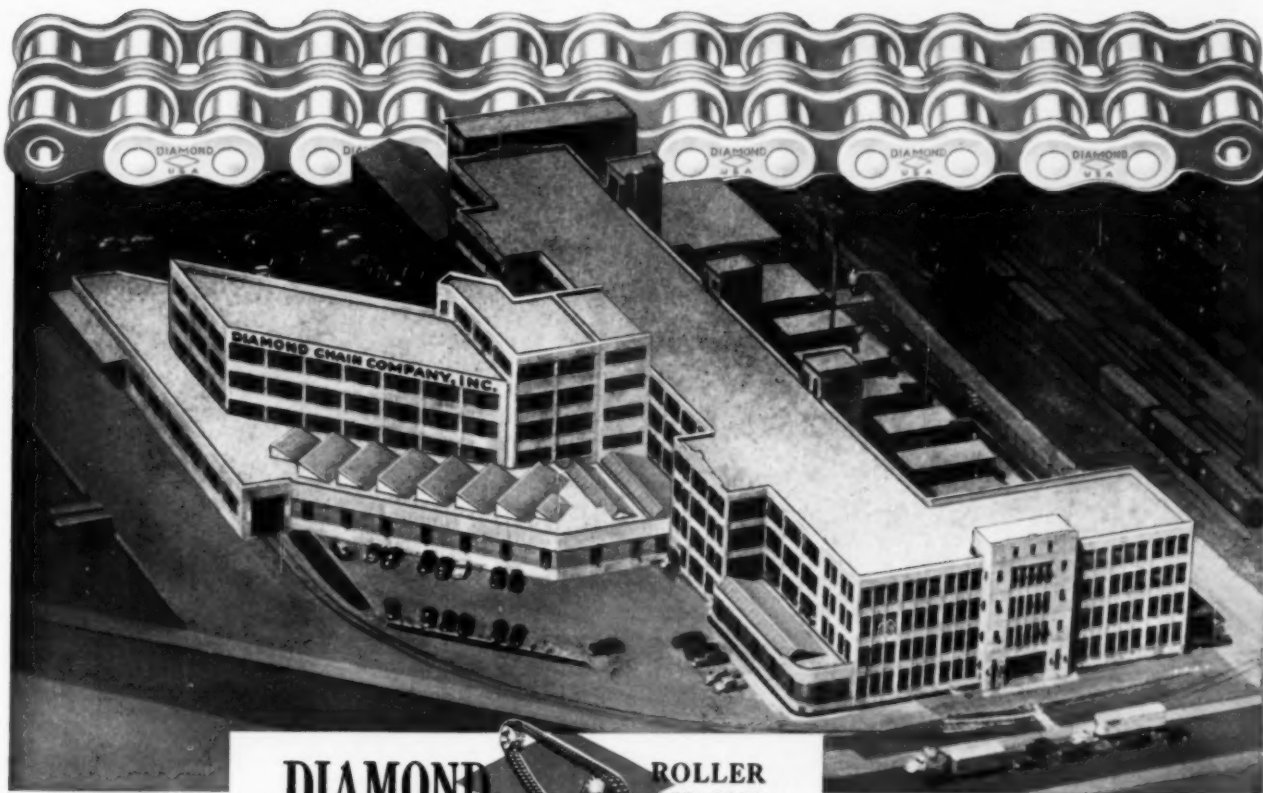
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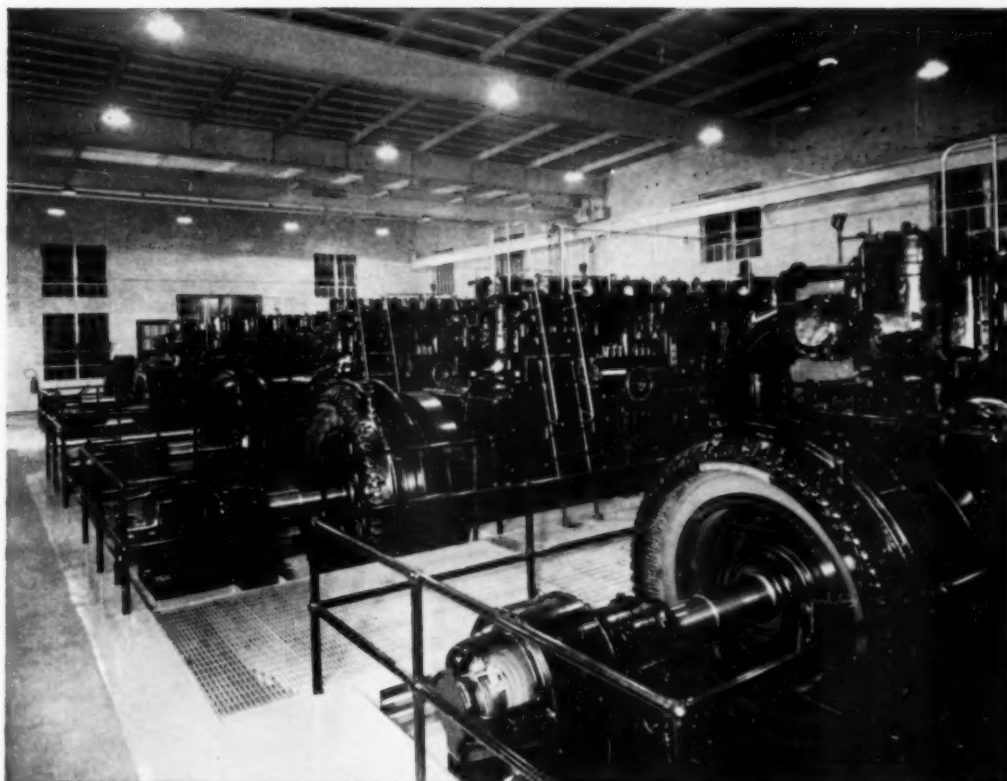
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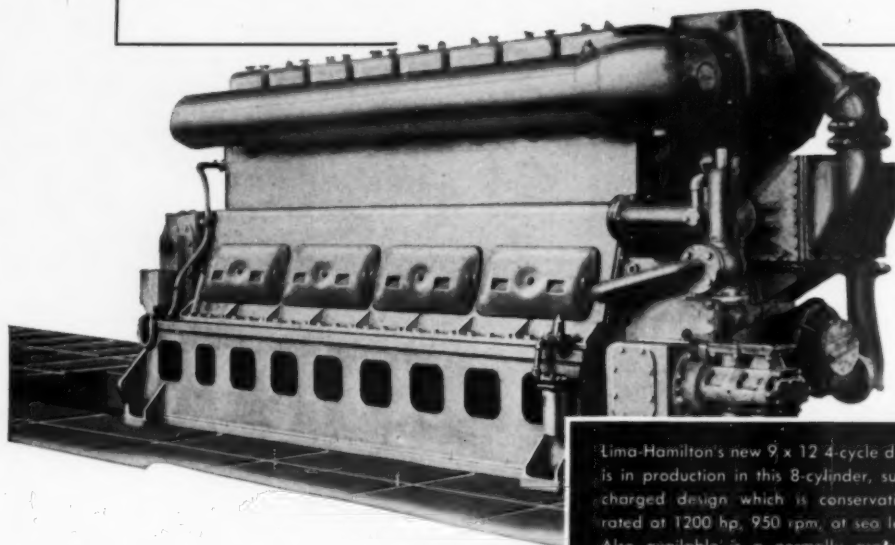
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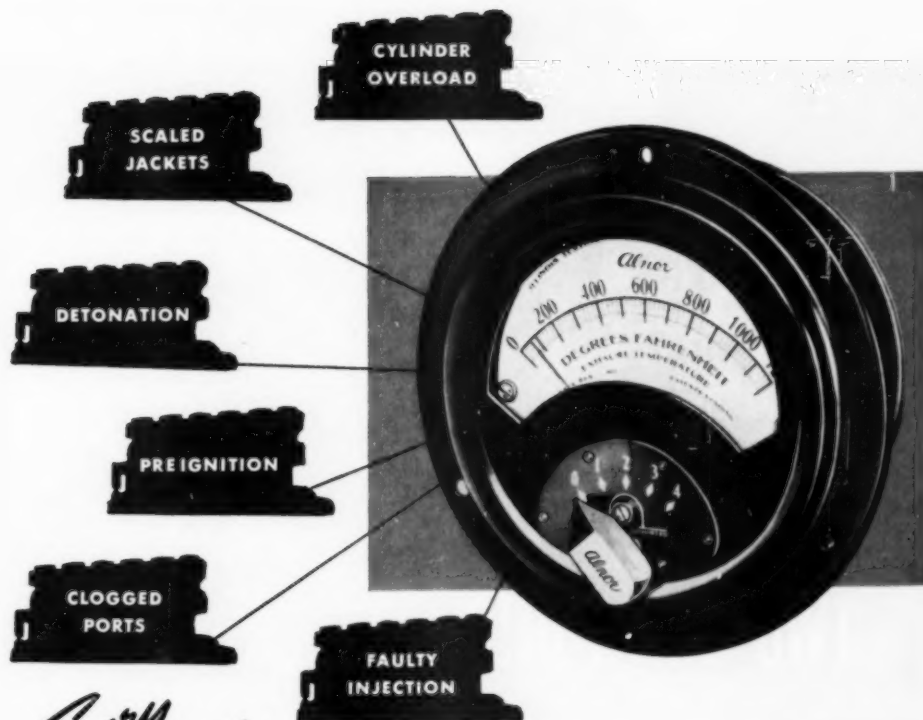
It all adds up to this: If you're considering a diesel in the medium-size range, you'll want to know more about this new 9 x 12. We will give you prompt specific answers to all questions. Write to Lima-Hamilton Corp., Hamilton, Ohio.

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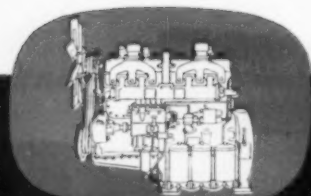
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For further information on these two fine oils, call in a Gulf Lubrication Engineer today.

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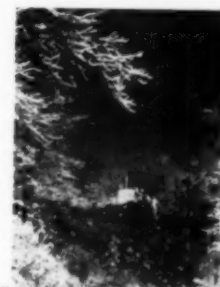


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Caterpillar diesel D2 tractor with No. 25 bulldozer blade clearing and grading for road near Peoria, Illinois.

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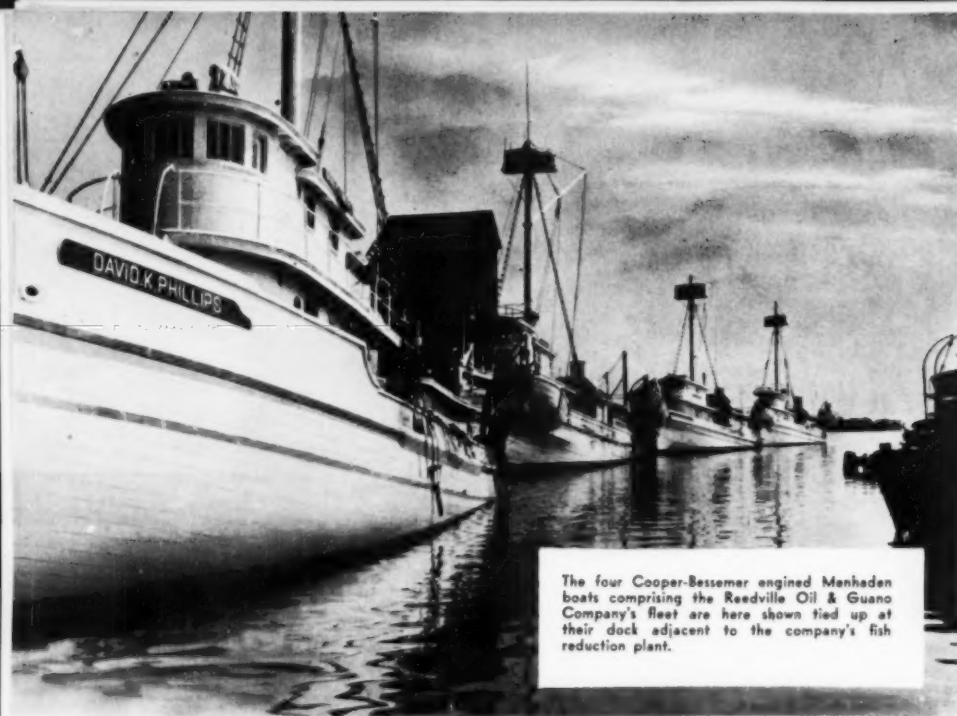
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E. H. Doddrell  
342 St. Paul's Corner  
Ludgate Hill

TULSA 3:  
O. F. Cozier  
515 McBirney Bldg.  
4-5555



The four Cooper-Bessemer engined Menhaden boats comprising the Reedville Oil & Guano Company's fleet are here shown tied up at their dock adjacent to the company's fish reduction plant.

## DIESELS DO TWO-WAY JOB IN MENHADEN

by R. S. LORING

**D**IESEL engines, although long used in the fishing industry for the propulsion of boats large and small, are now being utilized in another section of the industry, fish reduction in the plant of the Reedville Oil and Guano Company of Reedville, Virginia. Under the active direction of Mr. R. L. Haynie and his son, Mr. K. L. Haynie, Jr., this progressive concern has expanded enormously and all the latest modern reduction methods are used.

The buildings varied greatly in size and age. Some look to be scores of years old. Others, big, metal-roofed, quonset-type buildings, obviously new, seem by comparison like plant buildings of "tomorrow." All appear to be placed with little rhyme or reason. But such appearance can be misleading.

This is a picture shared by many of the fish reduction plants at Reedville and elsewhere—plants that have expanded and progressed in their methods through the years as the markets for their fish scrap, fish meal and fish oil grew. Actually there is now very little essential difference in the fish processing procedure used by the various modern plants.

However, the plant of the Reedville Oil & Guano Company can lay claim to at least one important distinction. It is one of the very few to have its own diesel-electric power plant—a new plant more than capable of meeting the power needs

of the company's full capacity shore operations. The power unit, housed in a separate building with quonset-type roof, consists of a supercharged diesel driving a generator, rated at 600 KW at 80% power factor. Since the present load of fish reduction operation is 300-400 KW, the power supply is not only adequate, but safely provides for a considerable expansion of shore activities. The power plant operates as a complete, self-sufficient unit. Radiators are used for cooling engine jacket water and water for a shell and tube type lube oil cooler, are installed adjacent to the power plant building.

The power plant control panel includes rocking contact type voltage regulator, and a watt hour meter, alternator and exciter field rheostats, synchroscope and synchronizing lamps, AC voltmeter and ammeter, DC ammeter, polyphase watt meter and frequency meter. The panel is also equipped with an electrically operated circuit breaker with dual over-current trips, as well as such standard items as ammeter and voltmeter switches, field discharge switch, synchronizing switch and engine governor control switch.

Although the new power plant will show sizeable savings in power cost as time goes on, there were still other reasons that encouraged and hastened the installation. Menhaden "factories," as they are called, have been operated largely by steam power in the past, followed more recently by con-

version to purchased electric power where available. In the case of the Reedville Oil & Guano Company, this source of power proved to be inadequate and not wholly dependable as their operations expanded—a condition that could not be immediately remedied. Thus, self-produced diesel-electric power was the safe, logical, and money-saving solution.

To permit full flexibility, the power plant control panel provides not only for independent operation, but also for parallel operation with the utility company serving the Reedville area. Power supplied by the utility can be taken from the secondary side of a transformer bank where the utility's 3 phase, 60 cycle, 6,600 volt high line service is reduced to 240 volts.

Getting back to our "tour of inspection," we finally emerged from the plant buildings and reached the Menhaden boats—four big sturdy vessels, tied up end to end along their dock. And a pretty picture they made . . . freshly painted a gleaming white, clean and trim from bow to stern, carefully conditioned for the months of continuous grueling work ahead. Failure of any vessel, or even slight delay due to operating difficulties, could be serious indeed. For once the season gets underway, the successful, profitable operation of the reduction plant depends on the volume of Menhaden caught and brought in day after day by these boats.

General Manager R. L. Haynie, Jr., representing the third generation of Haynies in the history of the company, explained some of the high points of the operation of their vessels.

These Menhaden boats range from 125 to 130 ft., 6 inches in length. Originally steam powered, all four are now engined by direct-reversing diesels, having been converted during recent years to gain the advantage of greater power, greater speed, and operation at a greatly lower cost than was possible with steam.

In 1947 two of the boats, the *William S. Bruster* and *Alden S. Swan* were fitted with direct-reversing diesels, rated 515 hp at 400 rpm, swinging 3-bladed propellers, 68" x 38" and 64" x 42" respectively. In 1945 the *Margaret*, largest of the four vessels, was repowered with a turbo-supercharged diesel, rated 730 hp at 300 rpm, swinging an 80" x 60" 3-bladed propeller. The remaining boat, the *David K. Phillips* was repowered in 1948 with a turbo-supercharged GS-8 engine, rated 610 hp at 450 rpm, swinging a 64" x 40" MI 3-bladed propeller. The larger engines have a 13" bore and 16" stroke, while the last named engine is a 10½" x 13½" diesel.

Speed, however, is now of increasing importance and this accounts not only for the dieselization of Menhaden boats in general, but for a trend to greater propelling power as new engines replace old. Competition within the Menhaden fleet is extremely keen. Once the fish are sighted, the boats reaching them first can choose the most productive spots and "make their sets" ahead of competitors. The more fish caught, the more the men will earn in shares, and the more a ves-

sel's "factory" will hum, a good incentive to work. The previously mentioned M/V *Margaret*, a 128-foot Menhaden vessel now engined by a supercharged diesel, rates as one of the fastest Menhaden boats of her size.

The boats usually return to the "factory" between 9 P.M. and 12 midnight. The unloading starts immediately . . . and the "factory" comes to life. Except for heavy weather, urgently needed repairs, or "off" Sundays, there can be no rest for these busy boats. Within two hours the are unloaded, washed down, provisioned and on their way back to the fishing grounds. Thus it is easy to see why their main propulsion engines must be able to show exceptional stamina and long-range, troublefree performance.

Reedville Oil & Guano Company's shore operations are mechanized to the highest degree. Conservatively, this plant can handle 50 tons of raw fish per hour.

The Menhaden fish are unloaded from the boats from troughs extending beneath the fish holds. Water under pressure is used to flush the fish through the troughs. The fish are then taken up by a suction pump and conveyed to a measuring hopper. From this point the Menhaden are mechanically conveyed through the various stages of processing, including steam cooking, pressing, drying, grinding and sacking. To the layman it is a surprisingly extensive and involved procedure, requiring large, expensive units of equipment for the most modern, most economical production of fish scrap, fish meal and fish oil.

In fact, the catching of Menhaden and the processing of Menhaden products has indeed become "big business." Rich in nitrogen and calcium phosphate, fish meal once had an important use as a fertilizer, but is now widely and almost exclusively used to enrich poultry and live stock feed as an

excellent bone-builder and egg producer. The extracted fish oil is used in the manufacture of soap, stains, varnishes, linoleum and similar products.

The Menhaden industry began in the vicinity of Reedville, Virginia, in 1870. Since then it has grown and spread extending from the waters off Northern Florida, where the fish appear in April, to the Delaware Capes and Long Island where the fish become abundant by the latter part of June. It is now estimated that the total value of the catches by the Menhaden vessels along the Eastern Seaboard exceeds \$20,000,000 per season.

Although the commercial fishing activities of Reedville are confined almost entirely to Menhaden, with a number of companies so engaged, it ranks at last report as one of the ten leading fishing ports in the United States.

It was here that Mr. John A. Haynie founded a fish reduction "plant" at about the turn of the century. The principal unit of equipment was his large iron "fish-cooking" kettle. It now rests on the lawn in front of a new office building of the company he founded and which, in 1913, became known as the Reedville Oil & Guano



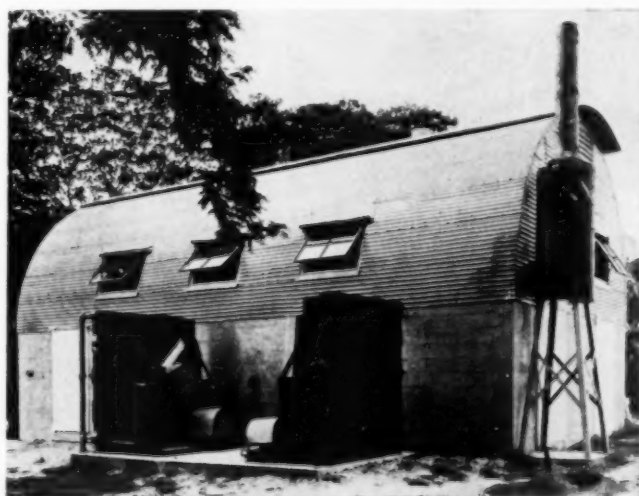
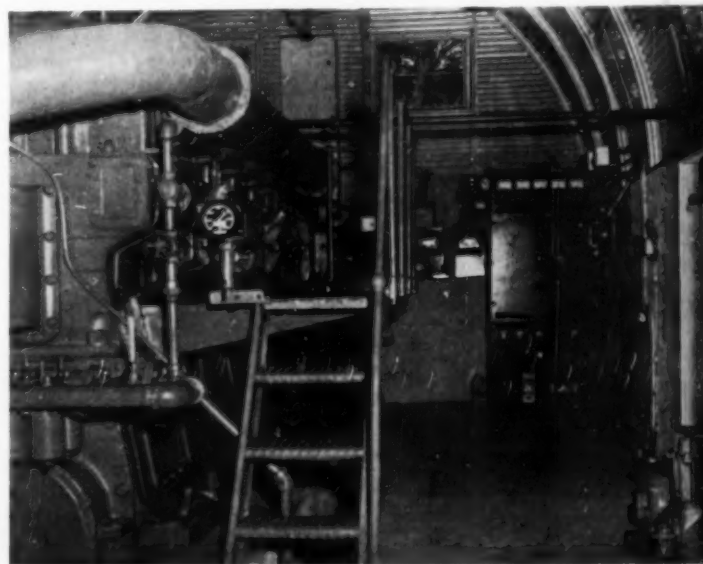
President R. L. Haynie and his son, General Manager R. L. Haynie, Jr., of the Reedville Oil & Guano Company.

Company. His son and grandson, now president and general manager, respectively, must often get great satisfaction from comparing this meager beginning with their methods and accomplishments of today . . . contrasting that beginning with their highly mechanized and modern diesel-powered facilities.

#### EQUIPMENT

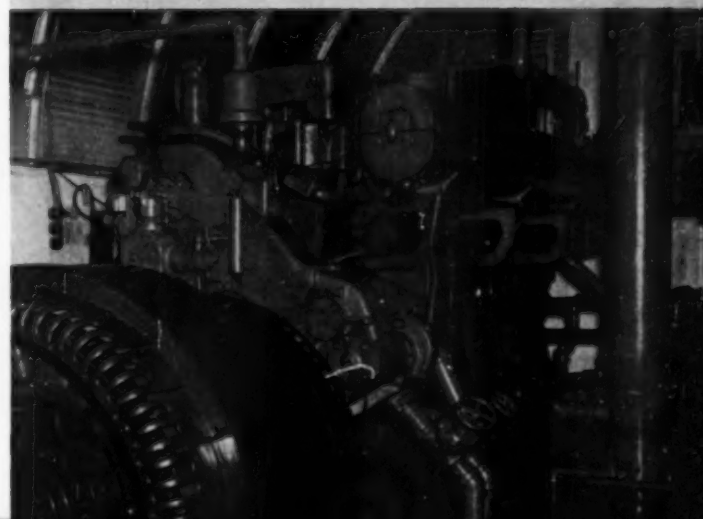
Power unit engine—Cooper Bessemer.  
Generator—Elliott.  
Radiators—Young Radiator,  
Oil cooler—Ross.  
Voltage regulator—Allis Chalmers.  
Other electrical equipment—General Electric.  
Fishing boat propulsion diesels—Cooper Bessemer.  
Propellers—Colimbian.

Operating side of 865 hp Cooper-Bessemer supercharged JS-6 diesel driving 600 Kw Elliott 3 phase, 60 cycle, 240 volt generator and belt-driven exciter in Reedville Oil & Guano Company's new shore power plant. Control panel is shown in background.



New Cooper-Bessemer-powered generating plant of the Reedville Oil & Guano Company is housed in this modern, well-ventilated quonset-type building. Note fan-cooled Young radiators in foreground used for cooling engine jacket and lube oil cooling water. Mazim Silencer to the right.

Exhaust side of JS engine showing generator in foreground. Since company's boats are likewise Cooper-Bessemer powered, mostly with engines of same type, maintenance is simplified and spare parts inventory can be held to a minimum.





# NEW DIESEL-ELECTRIC LOCOMOTIVES

by F. H. N. CARTER

**A**T the immense plant of the Electro-Motive Division of General Motors Corporation, La Grange, Illinois, Mr. C. R. Osborne, Vice President of the corporation and general manager of the division, recently announced not only the completion of the first production models of two new passenger locomotives that were previously announced to the trade early this year, but he also presented an extended line of switchers and road switchers for the industry.

The Electro-Motive E series of passenger locomotives equipped with two 900 hp diesels for a total of 1800 hp, was first produced in 1936. When its production was discontinued during the war to permit concentration on freight locomotives needed for the war effort, the horsepower had already been stepped up to 2000 per unit and it was built at this rating when production was resumed after the war.

Incorporating great design improvements and manufacturing processes that had been adopted in the manufacture of the F series of freight locomotives to improve quality and reduce maintenance costs, the new E-8 passenger locomotive which was recently on display at La Grange has thus been brought into closer harmony with the freight model production which has greatly increased man-

ufacturing efficiency. Some of the salient improvements in this locomotive are as follows:

By means of engine modifications and the development of a new generator, horsepower has been increased to 2250.

By using a silicone insulated traction motor with larger power cables and increased traction motor cooling, a 25% increase in continuous tractive effort has been achieved.

In order to provide a safety factor in passenger car heating as well as in propulsion which is obtained by the use of dual engines, space has been provided for two steam generators, which, it is claimed, is a unique feature.

All belts and sheaves have been eliminated in auxiliary drives these being accomplished by direct drives from engines or AC electric motors. Forced filtered air with provision for heating in the wintertime, keeps the engine room under slight pressure thus eliminating dirt and snow. An improved engine cooling system has been adopted which will maintain correct operating temperatures under the most adverse conditions. Danger of fires from punctured fuel tanks has been eliminated by the use of a combination fuel and water tank with the water section on the outside provid-

ing an envelope of water to oppose this hazard.

These and other improvements make the new locomotive an outstanding advance in diesel-electric arrangement of design.

The second new model on display at La Grange was an FP-7A which is basically a 1500 hp freight unit on which the car body has been extended four feet to permit installation of 1150 gallons of water with a 2500 lb steam generator and dynamic brakes. Thus this unit becomes available for both single and multiple operation in passenger service with adequate steam and water for train heating. Suitable for combination freight operation with the ability to haul heavy tonnage, this unit is a versatile member of the new E.M.D. line of locomotives.

The broadening of the E.M.D. line of switchers and road switchers is most comprehensive and has been accomplished in the following manner: A new 1500 hp, 125 ton road switcher has been introduced for use as a combination type locomotive for local freight, combination freight and passenger, branch line and yard switching operations. Of new design it is built to operate in both directions and the cab is located amidships to permit good visibility for switching operations.

The new 1500 horsepower General Motors Diesel Road Switcher Locomotive built by Electro-Motive Division of General Motors.





On inspection of this particular model, this unique visibility was very noteworthy.

Space has been provided for steam generator and water should the unit be used for passenger operations at any time.

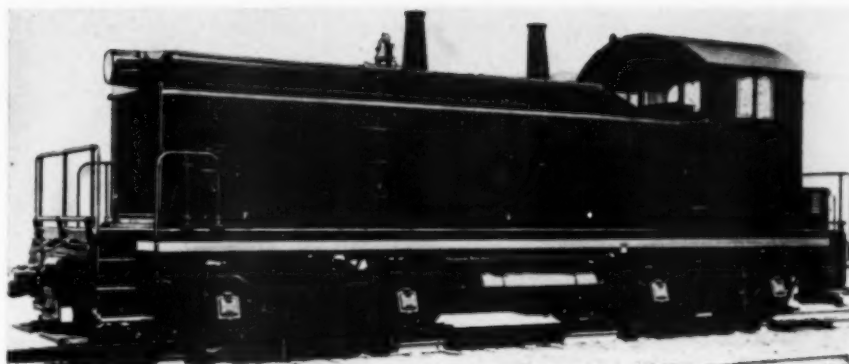
Another feature is that it can be equipped to multiple with other units of the same kind and with other E.M.D. locomotives for emergency service if required.

Of interest to travelers is the fact that a new engine throttle arrangement permits the gentlest operation in handling sleeping pullman passengers, but rapid acceleration is also available for kicking and dropping cars in switcher service.

The second change in the switcher line is the reclassification of the 100 hp, 125 ton model to a horsepower of 1200. This was possible because of a surplus of power in the diesel and the development of a new generator interchangeable with that developed for the new passenger locomotive described above.

The third change in this line will be the introduction of a new 800 hp, 115 ton yard switcher not yet in production.

The Electro-Motive switcher line will therefore be as follows:



The new 1200 horsepower General Motors Diesel switching locomotive, built by Electro-Motive Division, is similar in appearance to its 1000 horsepower predecessor, but has important new features.

- (1) 600 hp, 100 ton. (already in production)
- (2) 800 hp, 115 ton. (production in 1950)
- (3) 1250 hp, 125 ton. (new)
- (4) 1500 hp, 125 ton. (new)

Special multiple units are also available.

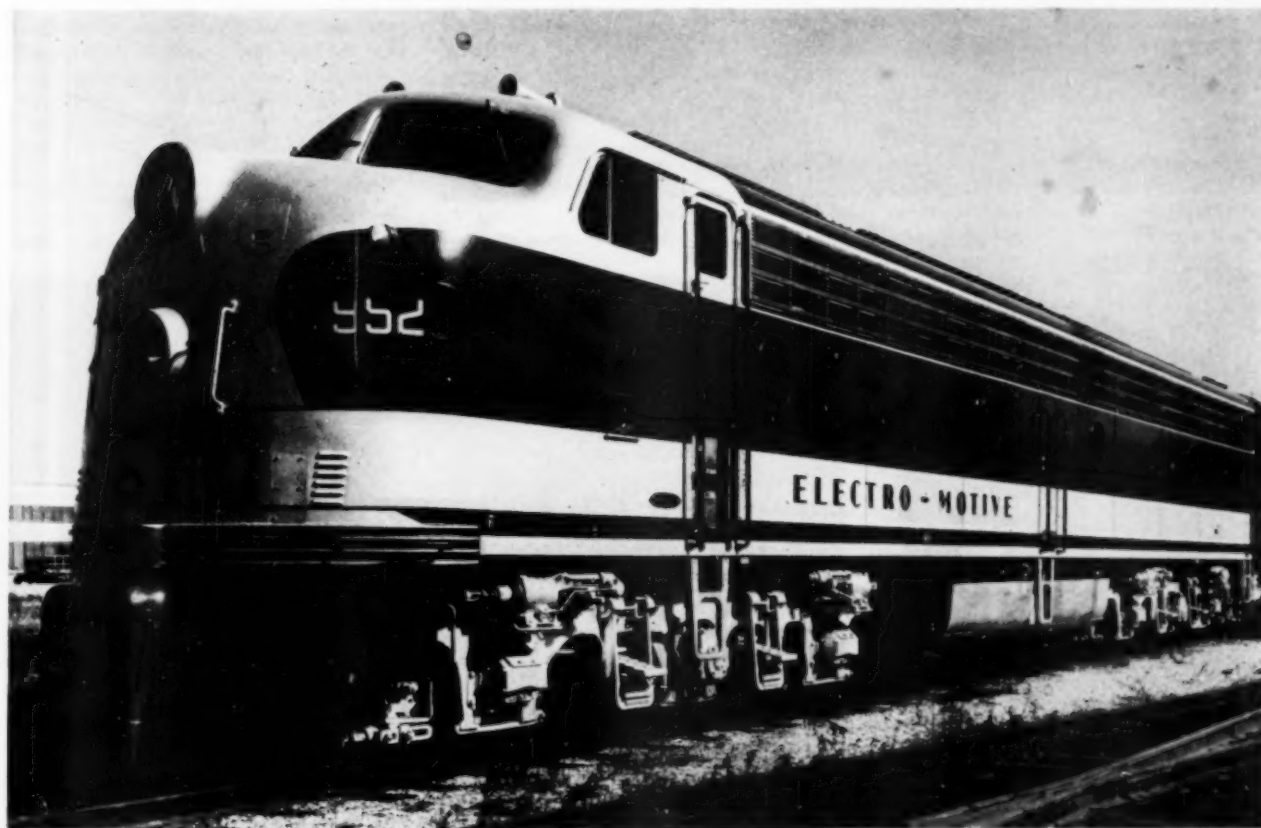
A great degree of parts interchangeability has been maintained not only between switchers themselves, but between switchers and passenger and freight locomotives.

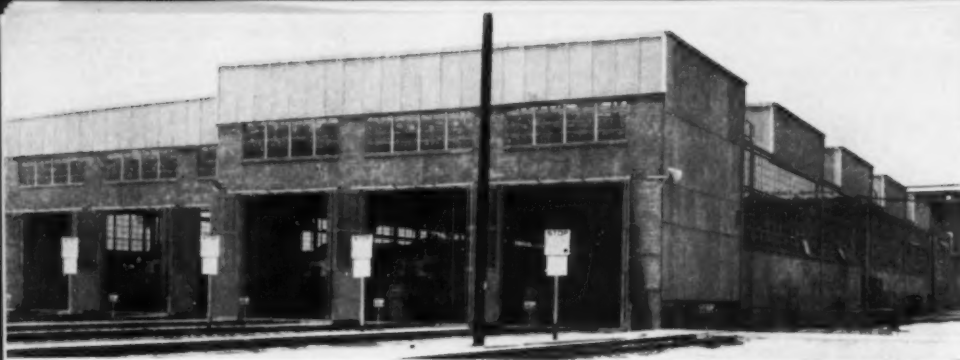
One of the most interesting points in locomotive design brought to our attention at La Grange was the careful attention that had been given to the simplification of maintenance by the elimination wherever possible of bearings requiring oiling.

flexible couplings requiring periodic lubrication and belt drives requiring continuous tightening and final replacement. As an example, the old passenger locomotive had forty anti-friction bearings requiring grease or oil and eventual replacement in the auxiliary generator, traction motor blower and compressor group. The new locomotive has only sixteen in the same group and twelve of these are sealed requiring lubricant only every five years.

Electro-Motive Division's production which is now double that of two years ago and quadruple that of four years ago, will, it is claimed, be capable of producing 2000 diesel locomotive units or over 2,500,000 horsepower per year in 1950.

The new 2250 horsepower General Motors high speed Diesel passenger unit just being put into production by Electro-Motive Division of General Motors.





Entrance end of new Southern Pacific Diesel Shops, Los Angeles.

## SOUTHERN PACIFIC'S MODERN, NEW DIESEL SHOP

by FRED M. BURT



Presently assigned and working in and out of the Los Angeles terminal are—

No.	Make	Type	HP
35	EMD (General Motors)	4-unit freight	6,000
6	EMD	3-unit passenger	6,000
4	Baldwin	branch line	1,500
28	Baldwin	switcher	1,500
1	Baldwin—600 series	switcher	1,000
10	EMD	switcher	1,500

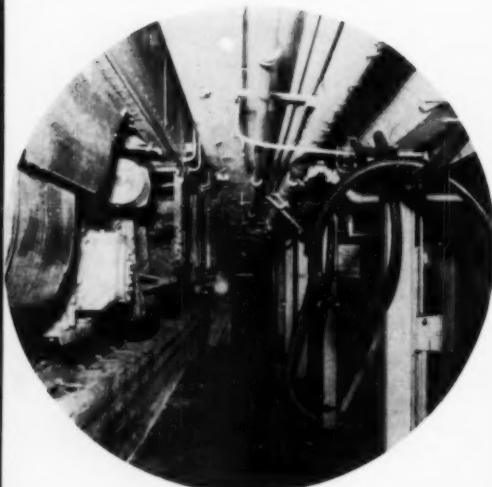
During a typical, recent 24-hr day, 30 diesel locomotives went through the various diesel facilities served by a total of about 400 men. For major overhaul (very infrequently required due to extreme thoroughness in progressive maintenance and in minor repair, replacement,) the locomotives go to the Los Angeles general shops.

Located in the large Taylor yards alongside the Los Angeles River, the main shop building is 140' x 278', with six inspection pits and platforms. Two more will be added later. Each pit is long enough to accommodate the longest of the 6,000-hp locomotives, more than 200 feet from end to end.

Workmen can stand on three levels while servicing and inspecting locomotives. In each of the upper level platforms between the pits, there are

Machine Room for parts overhaul, with office for supervisors and clerk in background.

Main shop interior. At extreme left and at right are lube pump controls and oil meters. Note exhaust system above.



Second level beneath platforms that separate pits; note pipe lines out of way above; hose for lube oil drainage; at right housing for 25' reel of hose for new lube oil. Above are ducts admitting fresh air for ventilation.



five, evenly-spaced, covered, lube oil hoses. Below each is a reel carrying a 25' long, retractable rubber hose used to supply lube oil. At the end of each platform there is a switch control used to actuate the pump that supplies the oil; also a meter to record amount of oil pumped.

Along one sidewall are lockers, numbered in the 100 series for first shift workmen, and 200 series for second shift; along the opposite wall the 300's for third shift.

Above each pit, the exhaust system ducts have a strong updraft through the action of six large, motor-driven blowers. In cold weather a heat input, from below, will maintain a comfortable temperature for workmen. There are three sets of controls for each battery of blowers, one on each side and one along the center pits. On or off status shown by red button lights.

At the inner end of the pits along the transverse platform is the long, maintenance sheet desk, with metal slot holders under the top edge, for each pit and for each type of work—1) Machinist, 2) Electrical, 3) Sheet Metal, 4) Miscellaneous. These are made up by the diesel clerk before the locomotive comes in, on the basis of the mileage and other pertinent circumstance or report, that determines the need for a certain service.

The "Passenger Diesel Locomotive Scheduled Maintenance Report—Home Terminal—L.A." (18 pages) and similar Freight (15 page) report are remarkably complete and time-saving. They cover all of the shop servicings—the ten designated from 2500 miles on up to several hundred thousand. Too lengthy to describe in detail, it suffices to say that from these inspections, work ordered and done, reports and records, a complete case history is built up on each unit in each locomotive. As the records build up, it is found that work can be "stretched." That is, for instance, jobs that might have been listed to do on the 30,000 mile maintenance may be found unnecessary until the 50,000 mile.

On the first page of the report instructions call attention to "Check Inspection Reports, Form L-2326, made enroute by each engineer at the terminal check points, (with one left at the terminal and the other brought in with the locomotives). This Locomotive Inspection Report must tell the whole story of condition of key engine working parts, and any repairs needed that the engineer can detect.

Operating around the clock every day, the diesel shops are under direct supervision of L. P. Oberkamp, Asst. Master Mechanic, and Mr. N. L. McCracken is Master Mechanic over all motive power and cars in the Los Angeles Division; there are machinist and electrical supervisors for each shift with relief supervisors to fill out the seven day week. Extra labor is obtained from the overall shop labor pool, working under a Shop Foreman.

Switchers are maintenance-serviced on a monthly basis (with worksheets used made up from the forms in the 14 page, road switcher & switcher diesel locomotives Scheduled Maintenance Report), in a nearby, older shop, also used for work on trucks and traction motors. On a track leading into this shop there is a hoist used to de-wheel switchers, with a 50-ton lift on each of the four screw lifts. A 50" wheel lathe is used to turn treads on all diesel wheels, and all steam tender-engine truck and trailer wheels.

When all main line diesel locomotives come in, after running through the automatic washer, they go to the "quick turn" track for sand, diesel fuel, distilled engine cooling water, raw water, and treated steam generator water (for passenger units.) Also samples of lube oil are taken from each engine for dilution test at the laboratory (another story). All of this is done in an average of 35 minutes. Then if the engine is scheduled for work in the diesel shop the hostler runs it up to the doors on the designated track where the machinist supervisor (generally) drops the STOP marker and walks the locomotive into the pit. At the door a special device is attached to

the train line airhose on the front end and the train line angle cock is locked so that no meddler can make it inoperative. At the end of the track there are two steel trips. A workman drops the first one as the locomotive reaches it at the proper low speed. The second and permanent "trip" (different locations for freight and passenger locomotives) is at a point just beyond where the front end of the locomotive must stop. If it overruns, an arm on the device trips and opens the emergency valve causing an emergency application of brakes.

All piping is hung from brackets under the top level platforms, for convenient access at the second level; air, steam, oil and water. The steam and lube oil pipes are close together, contained in a common insulated and metal covering thereby keeping the oil in a warm, fluid condition. Hoses of special rubber composition are used to drain lube oil, with a pump pulling it out and into the underground, 10,000 gallon, drained oil tank. All lube oil is re-refined, and after careful laboratory checking, with proper additives, is brought to a condition equalling that of new oil. From an outside, mid-building intake, air is drawn in by powerful blowers, to pass under tracks and then to be circulated through vents in ducts that run from the center to each end of the undersides of the platforms between pits. These will supply heat when required.

On the second track in, on one side, close to the entrance, there is a whiting truck drop table, with four 25-ton electric motor driven screws. Trucks drop down to a low level, are then carried below the adjacent track, out and up to an outside track. On this track they travel under their own power into the other shop, with an old portable arc-welding machine used as a transformer to supply the power.

At the other end of the shop there are three rooms—the cleaning room (with sheet metal shop in one corner), containing cleaning unit, to carry car body and engine air intake filters through a preliminary spray cleaner, an agitated solvent cleaner bath, and a hot, steam-water rinse. Then through a drying travel and into a centrifuge for a thin even coating of oil. On the other side of the room are tanks to clean lube oil filters. After removal of old, dirty elements the filter cases are cleaned in boiling alkaline Oakite cleaner, then hose-rinsed and re-assembled.

Cylinder heads, liners and other oily, carbonized engine parts are given a solvent cleaning with Magnus chemical in a Magnus Aja-Dip agitated bath tank, and then move on to the next room.

Here cylinder heads and liners, pistons, con rods, governor parts, steam generator parts, gages, injectors, water and fuel pumps, and other removable engine parts are reconditioned.

Next is the 55' x 73' stockroom with a stock of about 4,000 EMD and 2,800 Baldwin parts, worth about \$750,000. Minimum supplies of each item are kept under perpetual inventory. Parts, EMD and Baldwin in separate sections, are located in numerical order as per catalog parts numbers.





# FACTS ON BASIC RADIATOR DESIGN FOR DIESEL LOCOMOTIVES

by F. J. TAYLOR\*

**I**N cooperation with locomotive builders during the years that followed the acceptance of the first diesel locomotives by the railroads, the original, specially designed, efficient, durable, low-cost cooling surface has been changed and modified to improve its performance and structural characteristics. Such changes have been based, either on laboratory tests or examination of samples returned from the field, which failed under certain operating conditions.

Some of these changes were more or less minor revisions of materials and processes, while others were major design changes, necessitating complete re-tooling, but all were definite and substantial improvements, as evidenced by the operational records of units now in use after many years of railroad service, in all sections of the country.

Thermally, diesel locomotive cooling is no different than is required for most types of automotive equipment. Sufficient heat transfer surface

in the radiator must be provided to maintain the desired engine outlet coolant and lubricating oil temperatures, with the available coolant flows, air volume, and static.

Approximately 21.6 BTU/HP must be dissipated for the normal diesel engine, from the water jackets alone, and an additional 6.5 BTU/HP from the oil coolers. The heat of the oil coolers, of course, is transferred to water, which, in turn, is cooled by the air-water radiator, so that the total heat of the engine must be taken out through the water radiators. With a normal safety factor, so-called, because of unknown conditions—such as, dust, dirt, oil accumulation, etc., the engine requirements are increased 10%.

Space limitations in the cab, the large surface area required to dissipate the heat rejection of the engines, and the sturdy construction necessary for long, continuous operation in rigorous railroad service, are factors which must also be considered.

In passenger car and truck installations, considerable advantage in cooling is obtained from the forward motion of the vehicle, particularly at the higher speeds. This advantage cannot be applied to locomotive cooling installations for several reasons:

1. On the larger freight and road locomotives, there is obviously insufficient frontal area at the head of the locomotives in which to mount the radiators.
2. It would completely disrupt the streamlining of the locomotive.
3. The locomotive, at many times, is pulling its maximum horsepower on a grade, where the locomotive speed is not even equivalent to the air speed, as the wind at that time is usually blowing up the hill instead of down the hill. Also, switch-engines, of course, are working back and forth; therefore, the radiators could be theoretically on the front end in one direction, and on the rear end when the locomotive is in the reverse direction.

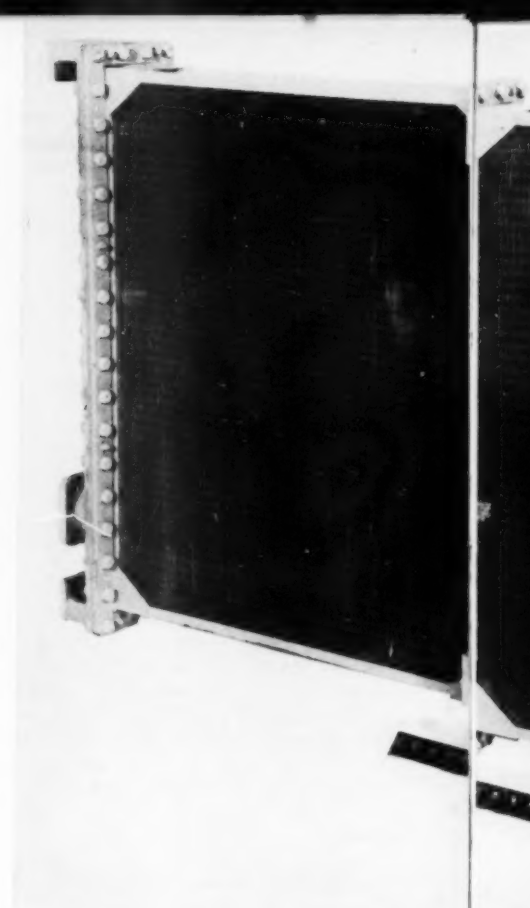
Fans, therefore, driven by the engine or electric motors, must provide sufficient air volume at the static pressure necessary to meet all cooling requirements, without the aid of locomotive motion.

The radiator manufacturer, of course, must rely

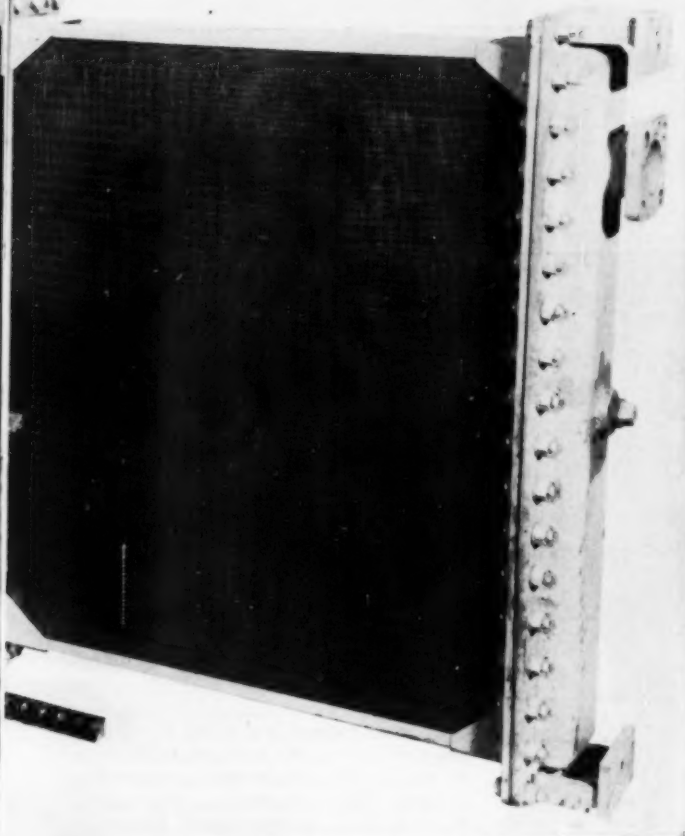
upon the locomotive designers and builders to provide adequate ducts, filters, fans, inlets and outlets, so that efficient use of the cooling surface will be assured, as an unlimited amount of cooling surface could be installed without adequate air and get no results, and conversely, of course, there is a practical limit to the amount of air that one can afford to pump over each square foot of cooling surface. Coordination, therefore, between the locomotive builder and the radiator manufacturer, with reference to the pressure losses allowed for the radiator, in conjunction with the cooling requirements of the radiator, determine the amount of frontal area required to do the job. Consideration must also be given to the static losses due to restrictions of entrance and exit grilles in addition to the radiator core surface when specifying fans. Care must be exercised in the selection of air inlet and discharge locations, in order to minimize the possibility of recirculation of the heated air, as obviously heat transfer surface efficiency or delivery is directly proportionate to the temperature differences of the mediums; i.e., air and water. Any reinduction, therefore, or exhausting hot air from the radiators, back into the inlet, tends to reduce the capacity of the radiators by the amount that the inlet air temperature is raised. In other words, it is the equivalent of operating the locomotive in warmer climates of the country.

Cinders seem to have a habit of getting into pretty nearly everything—when and how it happens, we cannot tell, but cinders have been found in the cooling water, and lube oil. Of course, this

\*Mr. F. J. Taylor is Assistant Chief Product Engineer of Harrison Radiator Division, General Motors Corporation, Lockport, N. Y.







Typical two-section fin and tube radiator for diesel locomotive use.

foreign material is neither good for the radiators, nor the lubricating system.

Therefore, mounting of the cooling units, to minimize the air flow restriction and recirculation, protect from damage by shock or differential expansion, simplify plumbing and provide accessibility for installation and removal, without excessive cost, requires careful planning and design ingenuity. The large size and weight of radiator required, prohibits any consideration of an integral design.

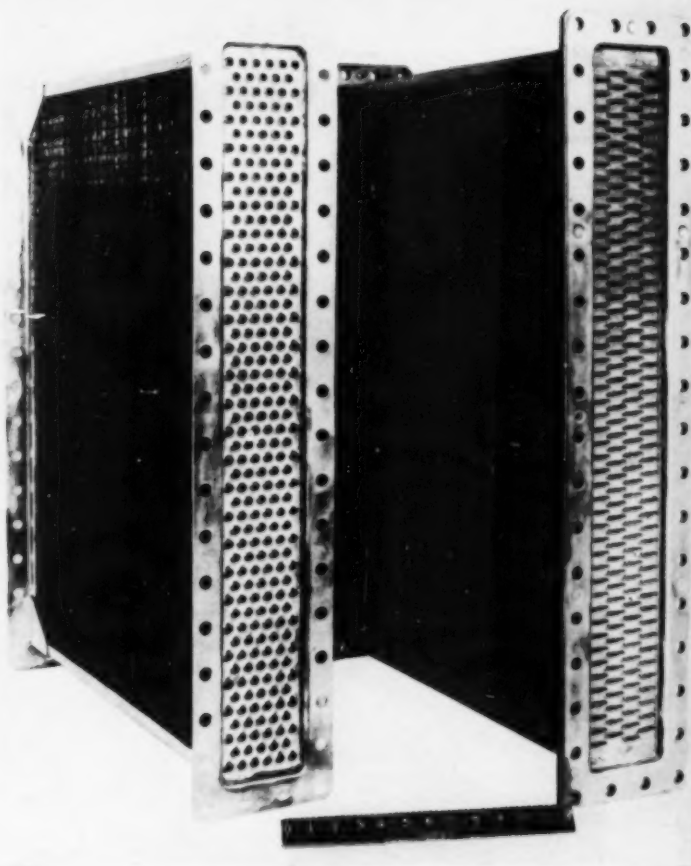
Because of manufacture, handling, shipping, installation and servicing difficulties, a multiplicity of interchangeable units, which can be installed or removed separately for repair or cleaning, is definitely preferred for locomotive service. Demountable units of this type must have heavy gauge header flanges with substantial steel reinforcements to prevent damage or distortion of gasket surface in handling and installation. The joint between the core tubes and header plates must be capable of withstanding the rigors of locomotive application, including coolant pump pressure, thermal expansion of the tubes due to varying coolant temperatures and road shock. This is accomplished by maintaining the proper fit between parts, and their unification by means of a material whose working temperature is not sufficiently high to render these parts undesirably soft and plastic. The proper fit, materials, and fabricating technique is accurately determined by shear tests.

An extra large tube section is desirable to permit circulation of the required volume of coolant flow of locomotive diesels, without causing excessive liquid pressure drops or high velocities that might result in erosion at the tube entrances. Maximum velocity to stay below this point is approximately 5 ft./sec. Also, the large tube area aids in preventing plugging of the coolant passages with foreign materials.

Before leaving the subject of the tube, we must consider the gauge of the tube wall, which is heavier than normal—this being necessary to provide structural strength and durability for long periods of continuous operation demanded in railroad service.

The reason for use of the flat-sided tubes in water radiators is interesting. The necessary direct surface required to balance the indirect with a minimum of restriction to air flow, is obtained in this manner as the amount of direct surface used in these tubes, if utilized in a round section, would be impossible to put in the existing frontal area of these radiators without an excessive restriction to air flow.

In view of this, a positive and uniform bond between the fins and tubes is essential to insure maximum efficiency of the heat transfer surface, and provide adequate support for each tube throughout its length. Lack of bond, even in a relatively small area, will permit "breathing" of the tube wall surfaces, due to fluctuation of



Round fin and tube and flat fin and tube locomotive radiator cones.

internal pressure and cause eventual failure of the metal at the tube edges. To prevent this, an extra heavy coating of solder is desirable on the external tube surface.

A very important part of radiator design is that the tubes used are sufficiently flexible to permit each tube to adjust itself from slot to slot, as it is pushed through the many fins of the radiator, and is then in a relaxed position, prior to the soldering operation. In other words, when the radiator is completely soldered, the tubes are under no stress from having been re-shaped after bonding to the fins.

By applying the solder coating to the flat stock, an extra heavy coating of fifteen to seventeen thousandths may be applied to the outer surface for maximum fin bond and a lighter coating on the inner surface for corrosion protection. The solder thickness is regulated by rolls and scrapers, and any surface irregularities are rolled smooth in the tube-forming operation, so no stacking difficulties are encountered when the tubes are inserted in the fin slots.

The completed core and header assembly is held together by means of heavy gauge terne-plate channels, reinforced at the corners with gusset plates.

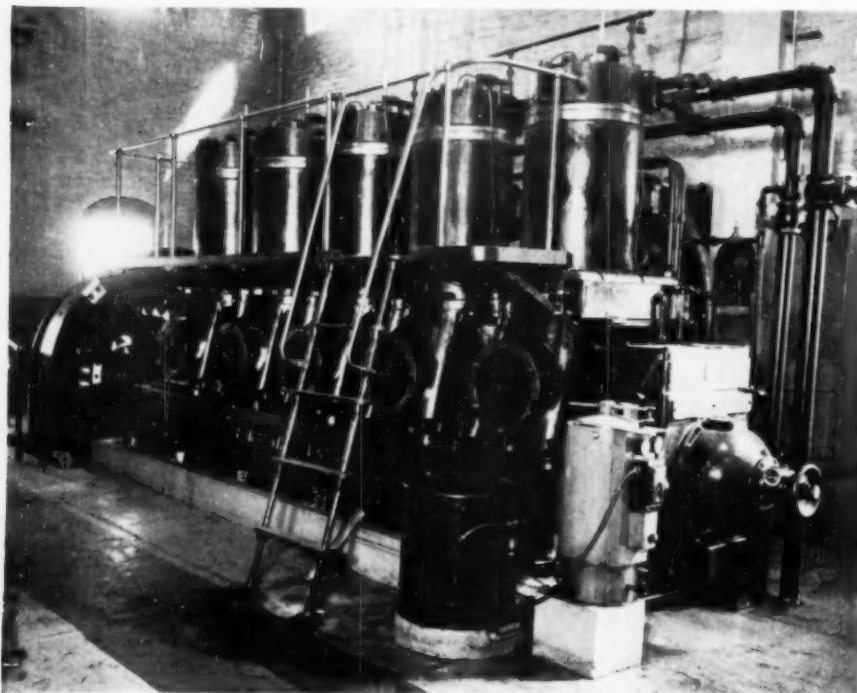
*Photographs through the courtesy of Harrison Radiator Division, General Motors Corp., Lockport, N. Y.*

## LEVEE GENERATING STATION . . . . . *Municipal*



Close to the Mississippi, a barricade of sandbags against floodwater can be seen at Canton, Mo.'s Municipal Plant.

Fairbanks-Morse 300-H.P. diesel operating since New Year's Eve 1932.



**C**OME hell or high water, the Canton, Missouri, municipal power plant keeps producing kilowatts for the homes, farms and industries of a sizable area in eastern Missouri. Whether the devil has appeared to plague them is a matter of question among plant operators, but certainly high water has made repeated assaults. Located on the west bank of the Mississippi, the plant has the protection of Canton Dam just a short distance upstream and of good solid levees. But still, in 1947 and again in 1948, the river overcame these restraints and only a secondary defence of sandbags around the plant and 14 pumps to expel seepage permitted continued operation. For three weeks in 1948, personnel had to come to work in boats, but the Fairbanks-Morse diesels continued to produce electric power. The plant still has \$5000 worth of sand bags encircling the building to guard against future floods.

Electricity at moderate cost is vital to the 2,200 people of Canton with a local glove factory, foundry, machine shop, grain elevators, garages and retail stores. Higher education is a major activity in Canton and a large bloc of power goes to Culver-Stockton College. Residents have installed more and more major electric appliances from year to year, increasing their dependence on these diesels at the river's edge.

Actually, the Canton plant is only 30 percent a municipal power station. Well over two-thirds of all power sold is used to energize the 1,400 miles of transmission line of the Lewis County REA, extending into the rural areas of five counties. Thus, in the fiscal year ending April 14, 1948, the Canton plant delivered to the REA co-operative 4,941,600 kwh. at an average rate of .01429 per kwh. The base rate to the co-op is .012 with a fuel price escalator clause accounting for the difference. Another 60,000 kwh went to the lock and dam at a flat rate of .02 per kwh. Canton residents purchased 1,689,985 kwh. at an average price of .033693. The prospects for 1949 are greater consumption at lower cost, for Canton is improving production efficiency and has found a solution to the high cost of fuel.

This is a veteran plant with a long record of profitable operation. Originally powered by steam in the early days of the century, the plant pioneered with internal combustion engines, installing two 100-hp. and one 200-hp. Fairbanks-Morse semi-diesels. These were followed by a 350-hp. air-injection Busch-Sulzer diesel. The first of the units currently in service was a 300-hp. Fairbanks-Morse diesel which was put to work on New Year's Eve in 1932. An 805-hp Fairbanks Morse diesel was installed in 1938 and the two 100-hp. units were retired. Two years later the 200-hp. engine was replaced with a 690-hp. F.M diesel. These engines carried the growing load all through the war years when plant expansion was impos-

## Diesel-Generators at Canton, Missouri

By WM. H. GOTTLIEB

sible and it was not until February 1946 that assistance came in the form of a 1200-hp. Fairbanks-Morse diesel and permitted removal of an oil air-injection unit. Latest addition to the plant was a second identical 1200-hp. diesel installed early in 1948. This was rapid growth but was essential to keep pace with expanding demand which rose from 215 kw. in 1937 to 2100 kw. ten years later. The REA co-op started drawing power in 1937 and has been a factor in the growth of the plant.

While meeting every demand for service, the plant has more than paid its way. Net profits after depreciation topped \$10,000 in 1940 and rose to a high of nearly \$21,000 in 1947. Then rising costs cut down the margin to about \$10,000 in 1947 and to a nominal profit in 1948. The devil in this picture is the cost of fuel, which in January 1948 was no less than 13.47 cents per gallon delivered. At this point, plant Superintendent W. A. Downey investigated the possibility of burning a Texas crude oil instead of the expensive gas-oil then in use. This meant a saving of more than 3 cents a gallon which, at the 1948 rate of consumption (670,524 gal) amounted to more than \$20,000 on the fuel bill. The crude was fed to the diesels the last week in May and has been used continuously ever since. At the time the writer visited this plant, operating records were available for June, July and August and the engines were producing better than 12.5 kwh. per gal. of fuel, more than 1 kwh. above previous performance. Mr. Downey reported that, aside from stepping up the fuel nozzle cleaning schedule, he encountered no problems in using the crude. Needless to say, the lower cost will restore previous profit levels for the plant. Anticipated lower fuel price levels will further improve this situation.

Canton values its plant on the books at \$273,863.01 with a reserve for depreciation of \$136,626.49. Total indebtedness at the end of the 1948 fiscal year was \$138,827.00 but there was \$111,780.31 in the electric utility fund surplus account. Thus, despite the vast expansion, the plant has a net debt of only \$25,000.

The new fuel, purchased through the Diesel Service Company, is delivered by tank car and unloaded by a motor-driven Roper rotary pump. Duplex Nugent fuel filters are mounted on the diesel engines.

Lube oil for the 1200-hp. units passes through individual Midwest filters; lube for the 805 and 690-hp. engines is cleaned in a Diesel Service unit. The 300-hp. unit is served by a Hilco-Hvflow filter. All four Model 33 diesels have oil-cooled pistons and each is equipped with a Schutte & Koerting lube cooler and strainer. Each of these engines also has a motor-driven auxiliary lube pump, either Roper or Fairbanks-Morse. Experience with en-

gine lubrication has been eminently satisfactory. Mr. Downey reports that he has never had a stuck ring and that he has not removed a bearing shim in at least 2½ years.

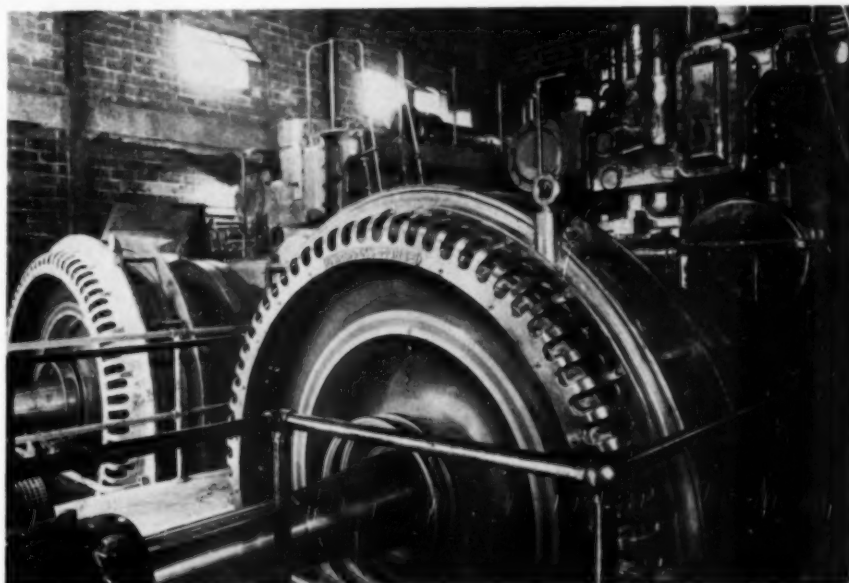
Mississippi soft water from the city's treatment plant is circulated through the engines and four Sims heat exchangers by a pair of motor-driven F-M centrifugal pumps with two additional pumps as standbys. Raw water is drawn directly from the river by two F-M Pomona turbine pumps driven by 20-hp. General Electric motors.

Intake air is filtered, in the case of the two big en-

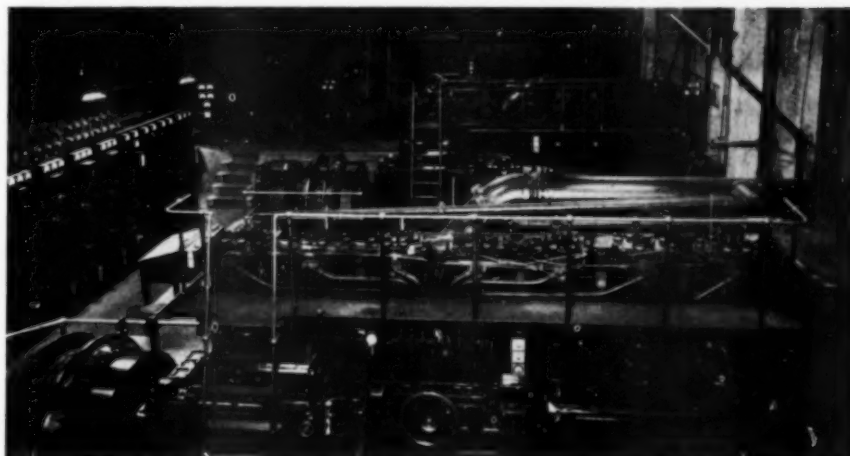
gines through duplex oil-bath filters and silencers mounted on a high steel platform behind the plant. Exhaust silencers for these engines also are mounted on the platform. Starting air is supplied by a motor-driven Quincy air compressor.

The plant is operated by Mr. Downey and his staff under the general supervision of Mayor Merl Hamill and five-member Board of Trustees.

Canton has met and licked every problem it faced from high water to the high cost of fuel. The past has been prosperous and the future looks better still for this generating station.



Latest Fairbanks-Morse diesels at Canton, Mo. Two 1200-H.P. units.

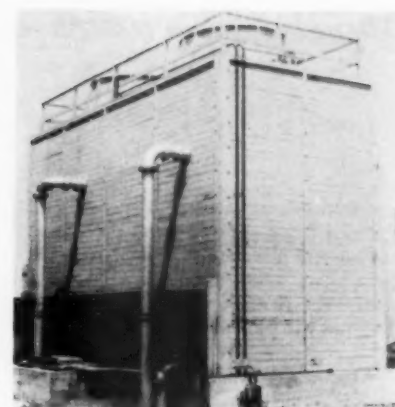


Over-all view showing four of the five Fairbanks-Morse engines at the Canton plant.



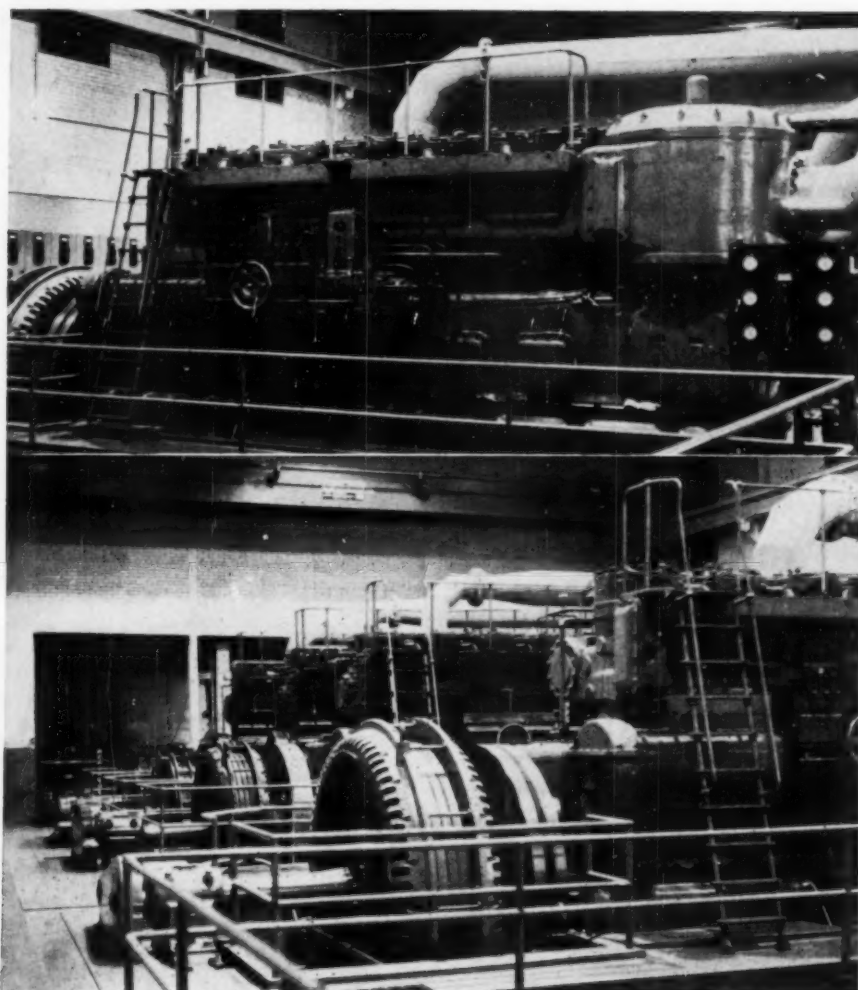


The new municipal light and power plant of Herington, Kansas, is completely modern in design and equipment.



The Marley induced draft cooling tower.

(First Below) The 1200 hp. F-M diesel recently purchased for the Herington plant. (Second Below) Main operating floor showing from foreground to rear the new 1200 hp. unit and two 560 and one 600 hp. units.



## HERINGTON, KANSAS

By A. V. REITER

**T**HE recently completed \$200,000.00 remodeling and expansion program of the Herington, Kansas, utilities has produced one of the most modern municipally owned power and light plants in the midwest. Major parts of the program were the purchase of a 1200 hp. Fairbanks-Morse diesel generating unit, and the erection of a new plant building. This structure, built over the old, is a model in design for utility and service. It is also a fine example of how a building housing power machinery can contribute to a community architecturally. And Herington's plant does contain four diesel engines totalling 2920 horsepower which in 1947 generated almost 6,500,000 kilowatts at a profit of close to \$48,000.00.

A \$200,000.00 program may at first glance seem a very ambitious undertaking for a community of 3800 population. But Herington, having known municipal ownership sixty years ago, has grown wise in its ways. As the "Herington Advertiser" wrote:

"The Municipal Plant has always paid its own expenses as well as transferred to other city funds considerable amounts to help finance the operation of the city, purchase equipment, etc. No taxes have been levied for the addition to the power plant just completed, nor will there be any for the purchase of the additional power as revenue bonds will be issued payable only out of the revenue of the power plant."

In round figures during the period of building up the \$200,000.00 fund for this project, annual contributions of from \$20,000.00 to \$37,000.00 were made from the plant's earnings to help finance other civic programs.

The expansion program, authorized by the city in 1945, was necessary despite the fact that the



Herington Army Air Field was no longer demanding service. This emergency measure went into effect when in May, 1942, army officials contracted with the city for power and light for its air field ten miles from the city, supplementing the large base at Topeka. Within the specified 21 days the entire ten miles of line was built, a 300 kva. sub-station was constructed at the plant, and the municipal power and light company began supplying the 270 kw. peak, and was prepared for the 876,000 kwh. annually. Still in the face of the withdrawal of this spectacular contract which taxed its then total output capacity, the normal growth of the plant has been so steady that the plant has had to be enlarged.

A study of the following table shows how, during the war, the army air base greatly increased demands on the Herington plant. It also shows that after the air base closed down the KW requirements from the increased use of electricity by commercial and domestic customers absorbed the kilowatts previously going into the war effort.

KWH Production at the Herington Plant

Year	KWH
1941	2,951,200
1942	3,206,900
1943	5,165,900
1944	6,382,900
1945	6,406,100
1947	6,376,700

In February, 1940, before the Army Air Field emergency, the municipal plant undertook serving over 1,000 customers of the Flint Hills REA cooperative throughout Dickinson, Geary, Morris, Marion, Chase, Wabunsee, and Lyon counties. This service was maintained throughout the war years along with the army contract and with the plant's normally increasing load. It is an unwritten testimony to the efficiency and loyalty of Mr. Raymond Nixon, plant superintendent since 1939, and his personnel, that this outstanding production record was managed with no additions to their staff.

During 1945, as a sample year of this period, the two 560-hp. and one 600-hp. Fairbanks-Morse engines produced over six million KWH with engine repairs amounting to only \$37.03. Contributing to this excellent performance was the modernization of the two 560-hp. diesels bought in 1928. In 1937, at which time a new 600-hp. Fairbanks-Morse diesel was purchased, one of the

560's was rebuilt giving it greater reserve capacity. The following year the other 560-hp. unit was modernized by the installation of high compression heads. That these improvements were effective may be shown by quoting from a letter written in 1939 by Mr. J. E. White, then superintendent of the Water and Electrical Department, in which he gives comparative data concerning the operating of the plant prior to installation of the new unit and the changeover of the other two.

"In 1936 our total gross KWH was 2,299,000 KWH, while the gallons of fuel consumed was 237,150 giving a KWH production per gallon of fuel of 9.69. In 1938 our total generation was 2,303,400 with a fuel consumption of 196,480 gallons giving a KWH production per gallon of fuel of 11.72 KWH."

During the past twelve months of operation the plant produced 12 KWH per gallon of fuel.

Today, the modern Herington plant is a witness to the substantial results gained from the use of diesel power under municipal ownership. From the year 1923 when the change-over from steam to diesel was made with three 200-hp. Fairbanks-Morse engines, the improvement in service and the expansion of the plant's earnings as well as property has been notable. At this same time also waterworks improvements were made, and the waters of Cold Creek three miles from the plant were impounded, covering about 317 acres and holding about 580,000,000 gallons of water, forming a recreation center as well as creating a water reservoir for the city. Since then the combined City Water and Electric Power Plant have used Fairbanks-Morse machinery throughout.

Five years after the initial installation, in 1928 \$63,636.00 of the earnings went to buy two 560-hp. engines to replace two of the original 300-hp. units. In 1937 a new 600-hp. diesel was added. With the recent purchase of the 1200-hp. engine in 1947 the total horsepower of the Herington plant is now 2920.

The following power cost data points up the fact that the gross profit of approximately \$18,000.00 for 1947 proves the municipally owned light and power plant to be very profitable to the City of Herington in spite of the rising fuel and labor costs over 1945 in the amount of about \$22,000.00. The management plans to reduce the

high cost of fuel by adding dual fuel parts to the new 1200-hp. diesel. These parts will be installed in the near future. It is conservatively estimated that this improvement will pay for itself in fuel cost savings well within twelve months.

Power Cost Data For 1947

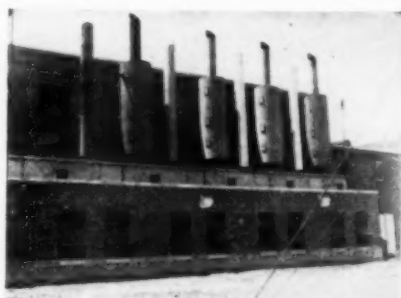
POWER PLANT	
Labor	\$13,730.60
Fuel cost	37,188.62
Lube oil cost	2,526.15
Waste and miscellaneous	3,301.93
Engine and plant repair	1,236.33
Insurance	1,309.44
Total Production Cost	\$59,293.06
DISTRIBUTION	
Labor	\$14,685.39
Supplies and repairs	4,762.38
Office expenses	9,352.90
Total distribution costs	\$28,799.67
GROSS RECEIPTS	\$136,048.36
OPERATING EXPENSES	88,093.73
GROSS PROFITS	\$47,955.63

The four diesel generating units are all of Fairbanks, Morse & Co. manufacture, consisting of two 460 hp. 16 in. x 20 in. engines, one 600 hp. 16 in. x 20 in., and one 1200 hp. 16 in. x 20 in. engine. Each is direct connected to Fairbanks-Morse alternators with Link Belt silent chain driven Fairbanks-Morse exciters. All engines are equipped with Woodward IC governors. The Westinghouse switchboard is of the latest design, affording the maximum for good control and records.

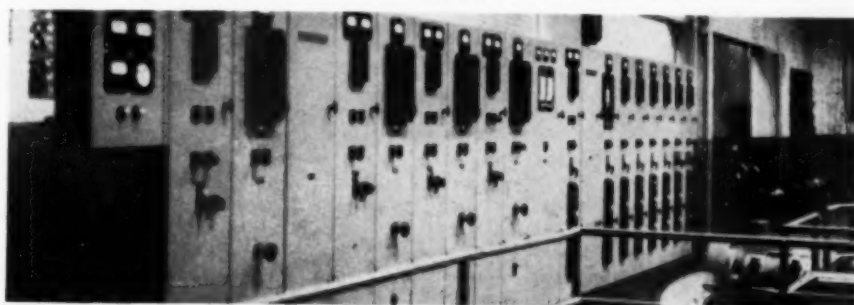
Fuel oil is purchased from various sources and is filtered by Purolator equipment. Gascon "C" lubricating oil as supplied by Sinclair is continuously filtered by Midwest Manufacturing Company machines, and cooled by a Ross and Schutte Koerting shell and tube type oil coolers.

The cooling water system is completely closed using a Marley induced draft tower, Ingersoll Rand circulating pumps, and Zeolite water softening equipment. All air to the engines is filtered through American OCH air filters. The exhaust temperatures are checked accurately by Alnor pyrometers. The exhaust silencing equipment consists of Maxim silencers. Valves and piping equipment was furnished by Ludlow and Crane. As in all modern power plants an overhead travelling crane is installed. Herington uses a Shaw.

Side view of plant showing Maxim exhaust silencers.



Engine control and the charting of records is made possible by this new Westinghouse switchboard.



# RE-REFINED LUBRICATING OILS FOR ECONOMICAL DIESEL OPERATION

• by H. T. MOORE

**W**HEN commercial oil reclaimers first became available some twenty-five years ago there was considerable reluctance on the part of industry to use them. But today, the objection that "once lubricating oil had been in service it broke down and could not be reclaimed" has almost disappeared.

Re-refining of oil is now pretty generally accepted as sound and thrifty practice by most large users of oil. Modern re-refining equipment, which incorporates many improvements over original reclaimers for which the first patents were granted, has proved itself capable of restoring used lubricating oils to new oil properties as originally refined. Many thousands of re-refiners are now in use on nearly every type of oil that lends itself to treatment for removal of impurities. It is estimated that more than 200 million gallons of oil are being re-refined every year, and that 500 million gallons of used lubricating oil—now wasted—could be reclaimed.

With the accelerated trend to diesel engined locomotives, trucks and marine vessels, and stationary diesels, many railroads, fleet and boat operators and power plants have been quick to realize the common sense economy of re-refining. Operating data has proved the high quality of re-refined oils, and the savings achieved have more than justified the initial cost of dependable equipment and its operation. It has been said that any company that can collect three drums or more of waste oil a month can economically do its own re-refining process.

It should be made clear here that, while the terms "reclaiming" and "re-refining" are sometimes used loosely and interchangeably, the industry regards them as meaning very different things. By reclaiming is meant removal of visible, insoluble impurities, and this can be accomplished by a simple filtering process. Re-refining means heat treating and filtering to re-condition oil to its original specifications. This requires special equipment that employs activated contact earth, controlled heat, agitation and filtering—similar to the sequence operations of lubricating oil refining—to remove both soluble and insoluble contaminants.

While there are many types and grades of oil, each made up of molecules built around various combinations of hydrogen and carbon atoms, all lubricating oil molecules fall into two general classifications: (1) stable and (2) unstable.

The structure of stable molecules is such that they do not easily combine with additional atoms of any kind. But the structure of the unstable

molecules permits them to take on additional atoms and they combine freely with oxygen whenever it is present. This is the main reason of oil "oxidation."

All oils have some unstable molecules and oxidize to some degree. The result of oxidation is some entirely new substance such as gum, tar, resin or asphalt, depending upon the structure of original molecules. These oxidation products are spoken of as "sludge" or "gunk." A certain amount of these oxidation products can be dissolved by the oil, but after the saturation point has been reached, they may be deposited in piston ring grooves and other engine parts. More important, this material may plug oil passages.

Lube oils in diesel engines suffer further contamination from:

1. Soot or carbon from incomplete combustion of the fuel and decomposition of fuel and lubricants.
2. Fuel dilution due to incomplete combustion and blow-by.
3. Water condensed from air or combustion gases. (In conjunction with other impurities water may cause oil to emulsify.)
4. Mechanical impurities such as road dust passing air filters; metal particles from engine wear; and rust.
5. Small amounts of soaps (products of reaction of acids and hydrocarbons and metals).

Continued use of oil will result in change of viscosity, flash point, fire point and neutralization number (acidity). The last mentioned is often the cause of corrosion and may also lead to further oxidation. If the oil is to be completely reconditioned, all of the contaminants must be removed, not only from suspension, but from solution as well.

While the basic process—for which one of the earliest re-refining units was patented by a Mr. James R. Miller in 1925—has not changed appreciably, the re-refining equipment now made by the Youngstown-Miller Division of Walter Kidde & Company, Inc., embodies a host of improvements to increase the convenience and speed of re-refining, range of capacities, and the quality of the final product.

In the first step in the re-refining process, used oil is mixed with a good grade of contact earth—preferably, a chemically activated Bentonite clay. The amount of earth can be varied to meet conditions of the oil being treated and may be as much as one pound of earth to a gallon of oil, or as little as one-eighth pound to the gallon.

After the oil is mixed with the clay, its temperature is raised by electrical heat. This drives off water, non-lubricating volatiles and fuel dilution, and also makes the adsorbent earth more active.

The adsorbent earth has a great affinity for sludge or gunk and, in the re-refiner, each particle of earth becomes coated with sludge.

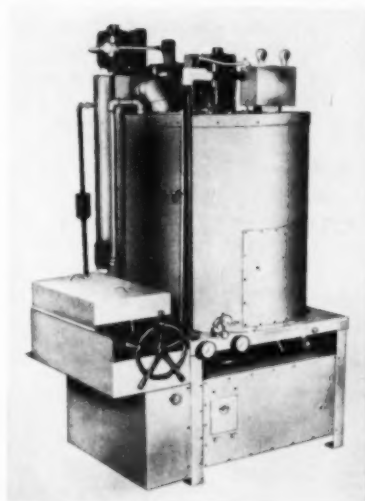
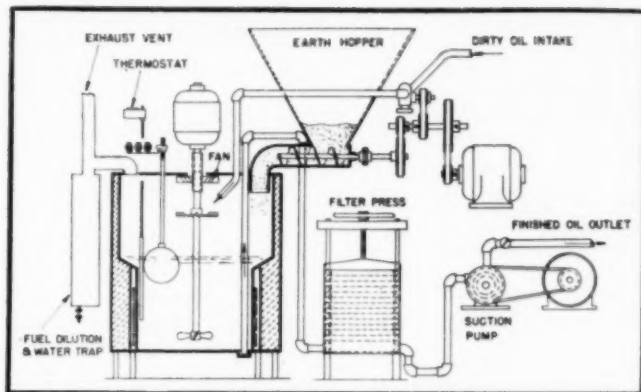
A draft of air is continually passed across the surface of the oil—while it and the adsorbent clay are being heated and agitated—by a fan mounted on the agitator shaft. This helps volatiles to escape freely, sweeps the area above the oil clean, and prevent condensation and re-entry of the released volatiles to the oil being treated.

By removing fuel dilutions, water and low boiling impurities with slow, controlled heating, used oil is restored to its original viscosity, fire and flash points. Presence of earth, similar to that used in oil refining, and elevated temperatures will lower the neutralization number to approximately new oil value, and will absorb oil-soluble impurities of the resin and asphalt types.

The last step in the re-refining process is filtration. This removes all solids such as dirt, metal particles, solid sludge and, of course, the contact earth. A two-stage plate and frame filter ensures removal of even the finest particles. The final result is a chemically clean oil, always suitable for re-use in the same service as the parent oil, if the "as new" was of the straight mineral oil type.

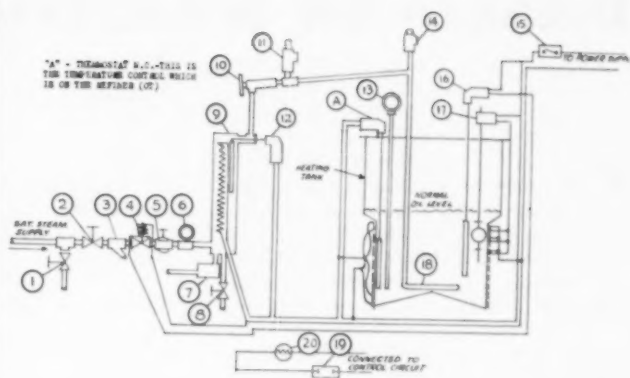
Almost all lubricating oils are available today with additives, at a premium price. Certain additives are intended to retard or inhibit oxidation of the oil, or to depress pour point. Others, of the detergent type, are intended to wash or remove sludge from engine surfaces and to keep in suspension and finely divided the products of oxidation, thus preventing them from depositing themselves on the internal operating surfaces of the diesel engine.

There has been considerable discussion over the extent to which re-refining removes additives. While no general denial can be made for the reason that additives used in different brands of oil vary widely, experience indicates that additives such as anti-oxidants and pour point depressants are left substantially intact through the re-refining process. In most cases detergent additives are removed by the earth treatment in the re-refiner. However, even if most of the detergent type additives are removed by the re-refining process, this constitutes no valid reason to forfeit the economies available. The fact is that if detergents are affected by re-refining, so too are



Youngstown-Miller Robot Refiner is almost completely automatic in operation, can produce clean oil continuously for many hours.

Single batch Youngstown-Miller Refiner, made in range of sizes from 9 to 200-gallon capacity.



Schematic arrangement of steam stripper parts for use on Youngstown-Miller Oil Re-refiners

1. Hand valve, condensate drain
2. Hand valve, steam shut off
3. Strainer
4. Solenoid valve, normally closed
5. Pressure regulator
6. Pressure gauge
7. Trap
8. Hand valve, condensate drain
9. Super heater
10. Thermometer
11. Relief valve
12. Thermostat normally closed attached to super heater
13. Dial Thermometer
14. Vacuum breaker valve
15. Manual switch
16. Thermostat normally open
17. Float switch for low oil
18. Steamer ring
19. Thermostat normally closed
20. Signal alarm

Re-refining cycle started in usual way. Superheater energized thru bi-rotary switch C.S. (15) on machine. Steam valve (2) is now opened. When oil reaches approx. 300° F. Thermostat (16) opens Solenoid valve (4) admitting steam into preheated Superheater (9) high temperature steam passing into oil through ring (18). At approx. 800° F. Re-refiner controls "turn off" all heat. Steam continues to flow cooling oil. At approx. 430° Thermostat (19) energizes signal alarm (20) notifying operator to complete processing cycle.

they affected in the engine being lubricated. Analysis of oil after reasonable service often shows that the original detergent has been completely consumed during engine operation.

In any case, it is now possible for users of re-refining equipment to purchase detergent additives separately and add them to their reclaimed oil in any proportion required by specifications.

There are two basic types of re-refiners in general use for lubricating oils in diesel engines: Batch charge machines, and continuous machines. The process steps in both are essentially the same.

Unit "batch" machines range in size from six-gallon to 200-gallon capacity. Each batch, regardless of size, requires about 90 minutes to process. Continuous "Robot" machines require very little attention by an operator, as the processing cycle is almost completely automatic, and they can produce clean oil continuously for many hours.

The continuous Robot machine has a hopper at the top to hold the contact earth and a screw to feed the earth into the dirty oil. Proportion of earth to oil can be varied to suit the condition of the oil and timing of the cycle is automatic. Because of its automatic controls and continuous operation the Robot machine will produce a given

amount of thoroughly reconditioned oil at lower cost than will a unit charge machine of equivalent size. However, the continuous machine is best suited to installations where only lightly contaminated oil is to be reclaimed in large quantities. For diesel lubricating oil re-refining the batch unit is recommended.

Equipment driven by Diesel engines occasionally encounter oils excessively contaminated with fuel dilution caused by faulty fuel injections or other mishaps. Reconditioning of this oil to new oil properties can be achieved through steam stripping the oil.

Steam stripping equipment is used as an adjunct to regular batch re-refining machinery. The re-refiner is connected to a source of steam which, before introduction to the oil tank, passes through an electric superheater. The superheated steam, at about 500 degrees F., enters the oil heating tank at the bottom, bubbles up through the hot oil and contact earth mixture, and carries off fuel dilution that would not otherwise be removed by the normal re-refining process.

With steam stripping equipment, oil with as much as 15 percent fuel dilution can be restored to new oil properties. Where fuel dilution exceeds 20 percent, it is questionable whether re-refining is economical, since less than 80 percent of the contaminated lube oil is finally recovered.

Where fuel dilution of diesel lubricating oil is encountered regularly in small amount steam stripping has proved practical and economical beyond any previously employed methods of oil reconditioning.

Depending upon the capacity of the machine used, lubricating oils for diesel engines can be re-refined for as little as 6 cents per gallon. In many cases the annual saving in overall oil costs have been more than several times the cost of the processing equipment.

Operators of re-refining equipment report a reduction in fuel consumption due to reduced friction encountered when operating with really clean lubricating oil. This saving alone often justifies the operation of a good re-refining unit in maintenance operation.

Savings possible through lube oil re-refining are best shown by actual operating data from users. Such information is available from every field of industry where diesel power is being used, on an ever-increasing scale.

Many re-refiners are in use among operators of diesel tugs and marine tankers.

\* Mr. H. T. Moore is with Youngstown Miller Division, Walter Kidde & Company, Inc., Belleville, N. J.



# DIESELS GO WHALING

By W. J. GRANBERG

**T**HE cry of "Thar she blows" is echoing again across waters of the North Pacific and killer boats that hunt the whale in response to that triumphant cry are all diesel-powered. So, too, are the tugboats which must tow the leviathans from the ocean to the whaling factory.

Whaling, absent from the waters off British Columbia since before the war, was resumed in 1948 by Western Whaling Corporation. The 1949 season saw operations continue on an expanded basis in a modern factory, or processing plant, at Coal Harbor on the northwest tip of Vancouver Island. This firm is the only one engaged in whaling in the entire North Pacific.

Hunting the world's largest animal is a chore that demands the best in marine engines, not only from the standpoint of speed and power, but for economic reasons. Whaling, if it is to be a profitable business in times of high costs for equipment, supplies and manpower, must see the

killer boats range quickly over large areas of ocean, and return as soon as possible with their bag so that the factory will have a continuing supply of whales.

This writer not only toured Western Whaling's factory, but went out in one of the whaling ships to learn just how the dieselized fleet operates. The factory itself occupies what once was a Royal Canadian Air Force seaplane base and the structures there, acquired by the company, and which include hangars and ramp leading to the water's edge, are admirably suited to whale processing. Coal Harbor is situated on an arm of Quatsino Sound, about 20 miles in from the sea.

The killer boats range to the south, west, and northwest of the island in search of whales which, once killed, are brought to a buoy in North Harbor, a few miles in from the sea on another arm of the Sound. From that point they are towed by tugboats to the factory where processing begins

immediately on these huge animals.

Three whaling ships are operated by the company, each with a crew of nine, and they are: *Nahmint*, *Tahsis Chief*, and *Kimsquit*. Two tugs, *Ivana* and *W. R. Lord*, are the hard working boats which tow the gigantic animals to the factory.

All the killer boats are wooden vessels and the *Nahmint*, Capt. Einar Jensen, master, is 115 feet long. It is powered with an eight cylinder diesel engine. Dan MacLeod is the engineer who keeps this power plant driving the ship at a good 11 knots. Fuel consumption amounts to 18 gallons an hour and the tanks hold 3,020 gallons.

The electric power generating units in the *Nahmint* consist of two 38-horsepower engines, with the generators providing 30 kilowatts each. There are two compressors, operating automatically at 600 pounds, for starting and, in addition, for perhaps the strangest purpose to which a compressor

One of the three diesel-engined killer boats, operated by Western Whaling Corp. from its base on Vancouver Island. The *Tahsis Chief* is a 140-foot, twin-screw wooden vessel.





was ever put: inflating whales. Once a whale is killed and brought to the ship's side by power winch and tackle, air is pumped into it to keep it floating and it is for this chore that the compressors are called into play. And it takes a lot of air to keep afloat a whale that weighs anywhere from 40 to 70 tons.

As are all the killer boats, the *Nahmint* is equipped with radiotelephone for communication with sister ships, the factory office, and the tugboats. In addition, they have radio direction finders and push-button steering system. This latter electrical device makes possible remote control of the steering system from the flying bridge, for once the ship is at sea, the wheelhouse is deserted in favor of the better vision afforded from the lofty steering platform atop the pilothouse.

The *Tahsis Chief*, Henry Mahle, captain, and Neil McKenney, first engineer, is a 140-foot, twin-screw vessel, driven at 13 knots by two diesels. The *Kimsquit*, also a twin-screw ship, is 130 feet long and is also engined with two diesels. Jack Haan is the captain of that vessel and Joe Enfield is the engineer.

Largest of the two tugs is the *Ivana*, 71 feet long, which is powered with a 120-horsepower diesel. This four-cylinder engine drives the tug at eight knots and uses five gallons of fuel an hour. When under way, electric power for the lighting system is derived from a 32-volt generating unit, while storage batteries are utilized when the vessel is in port. Ken Jordan is master of the *Ivana* and Nick Krulitski is the engineer.

The second tug employed in the heavy work of towing whales is the *W. R. Lord*, 67 feet long. The power plant is a 135-horsepower diesel. This drives the vessel at 10 knots. Torgeir Rysstad is master of this diesel tug and the chief engineer is Jimmie Pope.

The whale towing chore is a herculean one. The 27-mile run from the factory to the mooring buoy takes only three hours, but the long pull back up the winding, narrow Sound with two whales in tow, or maybe even just one, requires a good five hours. In addition to the dead weight of the tow, there are the strong running tides and cross currents in the narrows which demand the ultimate in power and the ability to hang on.

As for the whale hunt itself—there is high adventure indeed, and it is there, in finding, chasing and killing those huge animals that diesel engines put on command performances which demonstrate just what such engines will do when the chips are down.

The killer boats are licensed to hunt humpback, sperm, finback, sei and blue whales for a six-month period during the year, with the season at Coal Harbor opening May 1. The "humps" range so near shore they acquire countless barnacles, while the boats must go as far as 110 miles off-shore for sperm and blue whales. And the type of weather often encountered in that area of the Pacific belies the name of that ocean.

Habits of the varied species of whale differ widely and it is only by knowing them that a captain can be certain of bringing his ship near enough to one to make a kill. The number of times a whale will spout while he is on the surface and the length of time he stays submerged varies with the species. A humpback, for example, will blow five or six times and stay down about five minutes, while a sperm whale will spout anywhere from 15 to 25 times and stay submerged for about 20 minutes.

Once a whale is sighted by its blowing of air and vapor that turns to water the instant it strikes the cold air over the sea, then the chase is on, a hunt that may drag on for many hours, or maybe be over in one hour.

"She blows, captain! Off the port beam!" is the lookout's spine-chilling cry from his lofty perch in the crow's nest.

Then it is hard over with the helm and head for the whale, and at full speed, with the engineer coaxing that extra notch from the engine that can mean success or failure. The ship is perhaps half a mile away when the whale is sighted and the monster sounds before there is an opportunity to shoot. Now it is up to the skipper to estimate the direction the whale is taking, and to be right in its area when it surfaces again.

For the most part, out-guessing the whale is not too difficult, but now and then an erratic monster is encountered who declines to follow the orthodox rules of navigation and must be pursued in a zig-zag course over a very large segment of ocean. When the whale sounds, then the killer boat goes along easily at half speed on the estimated course for a minute or two and then the engine is cut entirely so as not to out-run it.

This time, perhaps, the ship is near the whale as it comes up and the prospects of a killing shot loom as probable. The vessel surges ahead at full speed. The harpoon gunner runs to his gun platform in the very bow of the ship, unlimbers the piece, and keeps it bearing on the whale. He must be within 125 feet of the whale before he fires in order to hit a vital spot, or so that the water does not deflect the harpoon.

The steel harpoon, which trails a one and one-half inch rope line through the air, weighs 132 pounds. In addition to the flukes, there is a small war-head bomb which explodes when the whale is penetrated. Such a weapon may be lethal, but it is not overly accurate, hence the gunner's desire to be in the best possible position before firing.

On target now. The whale is there, just off the bow. Erling Nelson, first mate and chief gunner of the *Nahmint*, levels down on his prey and squeezes the trigger. One and one-half pounds of cordite send the harpoon into the whale. Wild with fear, the whale leaps half out of the sea and then begins its swift run in a frantic bid for victory over the ship. The rope foregoer on the harpoon leads to a five-eighths-inch wire rope and

it is this that sings through the blocks and whips the water as the whale sets out.

It is a battle now between the ship and the whale as the diesel engine sends the vessel after the beast so that the strain of the lunging monster will not prove too great for the tackle. On and on they go, whale leading the way until death overtakes it. Then, slowly, the winch reels in the cable and line until the whale is beside the ship and secured by a chain around its tail to the port bow, body floating alongside.

In order to make towing easier, the whale's flukes are trimmed and then the rope foregoer is cut from the harpoon. A hose from the ship's compressor is now jabbed into the whale in a hole made by a pike pole and enough air is run in to make the whale buoyant. If it is early in the day and hunting is to continue, a bamboo pole with a red flag at the top of it is planted in the whale and the initial of the killer ship is cut in the whale as a mark of ownership. Should it be late in the day and prospects slight for obtaining another whale before dark, then the kill is hauled immediately to the mooring buoy in Quatsino Sound to await the tugboat which will tow it to the factory.

That, in short, is modern-day whaling—pursuit of the whale in diesel-engined vessels which are a far cry from the sailing ships of two hundred years ago which sent men out in dories to hunt with spears. And instead of stripping the whale of its blubber only and discarding the carcass because of its weight, virtually the entire animal is utilized today by having sturdy tugs tow it to the modern factory. D. W. Souter is manager of Western Whaling Corporation and was host to this writer in getting the story on the use of diesel engines by the company.

The diesels mentioned in this story are Atlas Hercules, Caterpillar, Cooper-Bessemer, Cummins and General Motors. The air compressors are by Gardner-Denver. The steering is an Allen push-button system.

The power plant of the tugboat *Ivana* is this 120-horsepower diesel which drives the 71-foot craft at eight knots. At the left is Nick Krulitski, engineer.



# COMPRESSOR PLANT BOOSTS CAPACITY OF "BIGGEST INCH"

by FRED M. BURT



**W**ITH the recent addition of the eighth and ninth compressors, the capacity of the Blythe Compressor Station provides delivery of 405 million cu. ft. (MMcf.) of Texas natural gas daily, into the *Biggest Inch*, a 214 mile long, 30" diameter pipeline system supplying the Los Angeles area. It is a joint accomplishment of the Southern California Gas Co., and Southern Counties Gas Co. of California, with operations of the station by the latter; Glen Vail, Plant Supt., and Floyd Cramer, Plant Foreman.

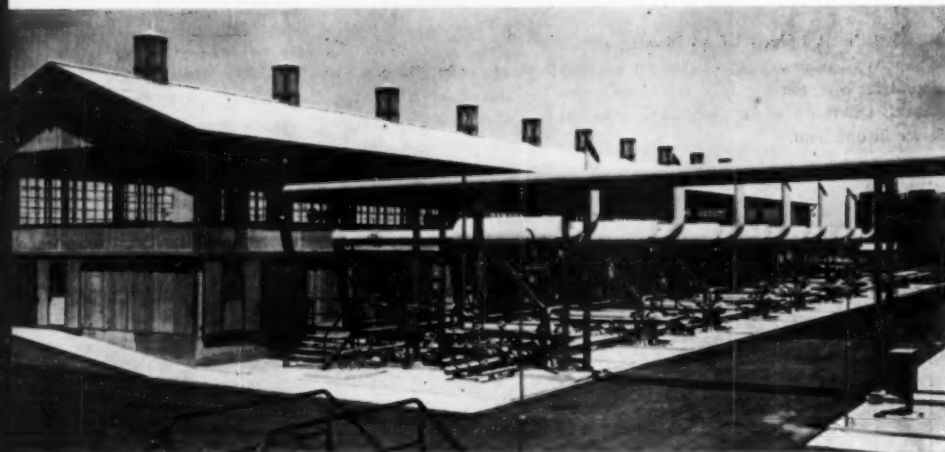
In the Palo Verde Valley, three miles from Blythe, Calif. and 6½ miles west of the Colorado River, the Blythe Station occupies 17 acres of a 10 acre site. Texas gas was first delivered across the river, after a 1,000 mile trip through the El Paso Natural Gas Co. line, on Oct. 30, 1947. By Jan. 10, 1948 it was coming through at a rate of 175 MMcf. daily, with gradual increase to 215 MMcf. during 1948.

In order to increase the capacity to 305 MMcf. daily, the 11,200-hp compressor plant was built and by Feb. 15, 1949, 305 MMcf. of gas was being delivered into the 30" system.

The gas is first metered at the delivery point and then a check measuring through five 16" orifice meters is made as it enters the compressor plant. During the long trip, the gas has picked up rust, grit and pipe scale. This is removed in gas scrubbers immediately after the metering. The gas is bubbled through an absorption oil in five scrubbers, each 18' high, 60" diameter, with 70 MMcf. processing capacity per 24 hours.

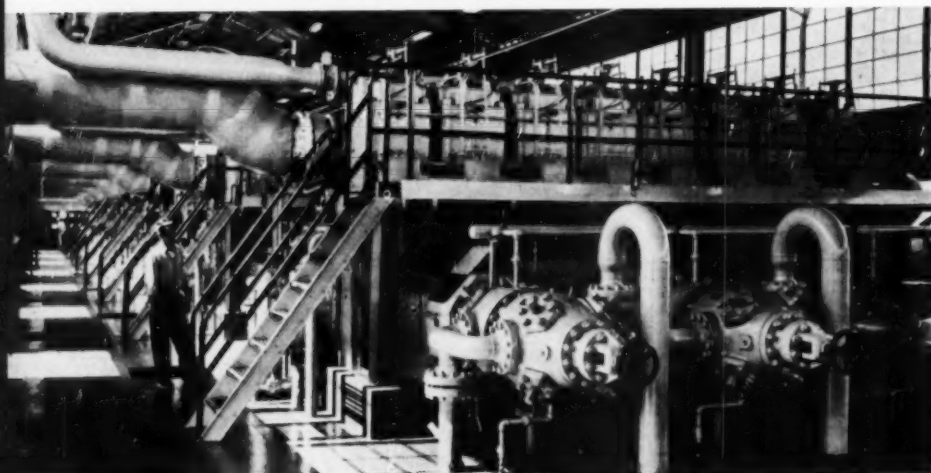
After the "scrubbing" the gas is run through the

Electric generating units with 250-kw G.E. generators powered with 370 provide air

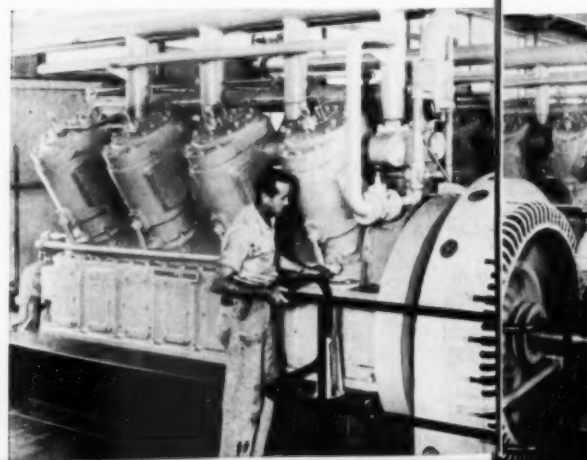
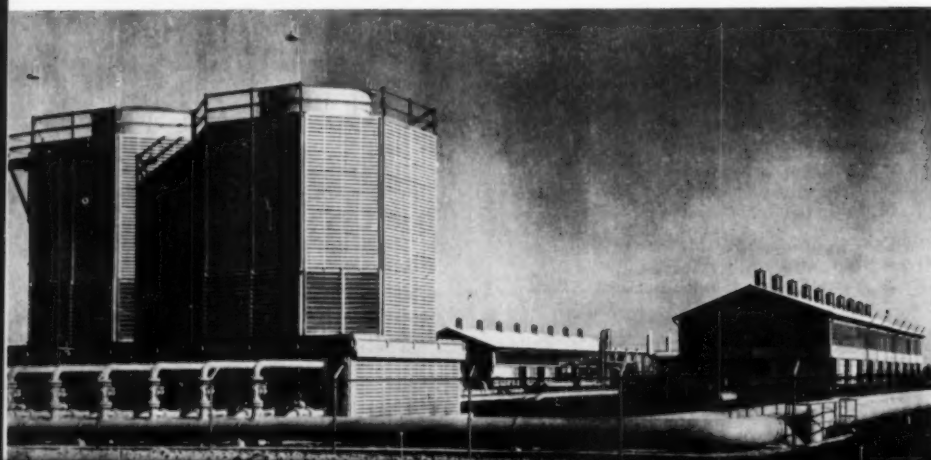


Compressor building with intricate outside piping system and Maxim silencers on the first seven engine-compressor units.

Seven Clark compressors with a total of 11,200-hp; with two recently added units bringing total to 14,720-hp.



In foreground two-cell, Fluor gas-cooling tower; in center is auxiliary building, at right compressor building.





2 years ago a cow pasture, today the company's largest compressor station. At left are the five Blaw-Knox gas scrubber tanks.

compressors to boost the incoming or suction pressure of 480-psi to a discharge pressure of 807-psi. These units are in the main compressor building, 242' long by 44' wide. The original installation included seven right angle compressors. The compressor engines are rated at 1600-hp each, and have eight 17" x 17" vertical cylinders, with direct connection to four 9½" bore x 17" stroke, horizontal, double-acting compressor cylinders. Pulsation dampeners are installed on both the suction and discharge sides of each unit which weighs 60-ton. Each engine exhausts through heavily insulated piping into a horizontal Maxim silencer.

The two new, heavy-duty compressors that will deliver an added 100 MMcf. per day, rate 1760-hp each, weighing 98½ tons apiece. Their movement of 4½ miles from railroad to plant by road was quite a job, taking but 2 hours apiece actual moving time. The compressor, engine and appurtenances were moved separately. Two tractors with 200-hp and 300-hp diesel engines were used for this.

Only the compressors and auxiliary equipment are housed in the main building as it is a Class B hazardous location. All of the electrical equipment and instruments are explosion-proof. Fluorescent lights are completely sealed and the electric clock is housed in a separate sealed case with power transmitted through a stuffing box.

The main engine room has colored concrete floors, colored equipment bases and a sub-basement, full length, for piping areas. The rigid, steel frame structure has flat transite sidewalls and corrugated transite roofing. The north wall was made detachable for removal when the last two units were

brought in. To make the building dust-tight, webbing was installed around the doors, windows are non-opening and all joints are sealed with mastic. Roof ventilators have dampers for closure during dust storms.

The pressure-boosting raises the temperature of the gas about 75°F, so that it is passed through Fluor cooling towers to drop the temperature to about 10° above the pre-compression level. The 162' x 38' auxiliary building houses the plant office, machine shop, a water softening system, a central refrigeration system to circulate water cooled to 38° to nine employees' residences; also auxiliary engines, generators, cooling water pumps and compressors.

To power all motors and provide light in all buildings and residences, three 250-kw, 440 volt, three-phase, 60 cycle generators are direct connected to three gas engines rated at 370-hp 11" bore x 13½" stroke.

Starting air is furnished by two compressors, one powered with a gas engine, the other electrically-driven. They also provide instrument air at 150-psi and utility air at 100-psi. In putting the equipment into operation, the gas-fuel compressor pumps air at 250-psi into three receivers 12' high x 4' diameter. This air then starts the engines on the generator sets which provide current to run the pumps and the electrically-driven compressor set.

Induced-draft, redwood cooling towers are used for both gas and jacket-water cooling. For the gas, a two-cell tower operates in a single stage with two-pass cooling coils. It is 28' wide, 52' long and 31' high with a capacity of 2400-gpm. Water entering the tower at 97° leaves at 86° at 80° wet bulb. Gas is cooled from 125° to 95° at 807-psi.

The four-cell jacket water cooling unit is 28' x 100' x 47' high, with 5000-gpm capacity at 105° intake temperature; 85° out at 80° wet bulb. Temperature of jacket water for the generator sets is 160° out and 150° in. The fan in each of the six cells is powered with a two-speed motor; high speed for summer, low-speed for winter.

In the westernmost sector of the yard there are two 325' deep water wells, each with a two-stage, turbine pump of 425-gpm capacity; also a 14' x 20', steel and transite pump-house, three 2200-bbl

water storage tanks, (two for raw water storage and one for treated water). And four 6,000-gal. oil storage tanks enclosed with a concrete-diked firewall; used for scrubber oil, main engine lubricating oil, auxiliary engine lube oil, and used lube oil.

In the pump-house there are two fire pumps each of 500-gpm at 125-psi capacity. One is driven with a 50-hp motor, the other by a gas engine. They supply a dozen dual hydrants strategically located throughout the plant.

All facilities work hand-in-hand with an emergency shut-down system, with five stations as control points in case of fire or explosion. At any of them, by opening a valve, the pressure can be reduced in the emergency shut-down header which closes two piston-operated valves on both 30" suction and discharge headers, where they enter and leave the plant. This also automatically opens a piston-operated valve which bleeds down all high-pressure lines except the fuel supply to the gas-engine generator sets and to the pump gas-engine. In extreme emergency virtually a complete shut-down can be effected except for the engine-driven fire pump which is then supplied with gas through a special, direct pipeline to the incoming Texas pipeline.

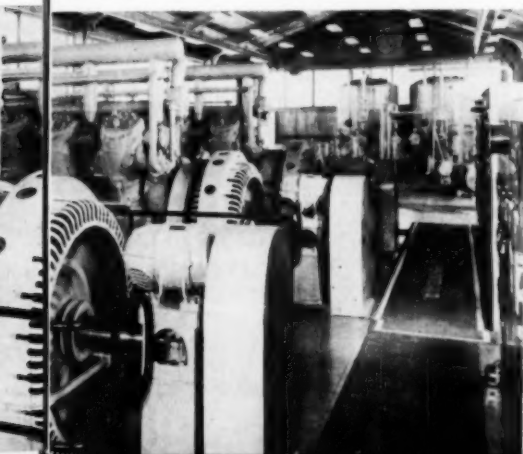
Installation of the 60 and 98½ ton compressor units on the fine desert silt posed some special problems for the J. B. Gill Corp. construction crews. Because of the high water table, heavily reinforced concrete foundations were poured in one 22" thick slab over specially prepared, decomposed granite subsoil which had been carefully compacted to provide a solid base.

The operation of this compressor plant was a life-saver for Los Angeles area users of gas during the unusually cold 1948-1949 winter when gas consumption ran up to one billion cubic feet on some of the colder days.

#### EQUIPMENT

Gas Engines—Ingersoll-Rand.  
Starting Air Compressors—Ingersoll-Rand.  
Generators—General Electric.  
Compressors (Gas)—Clark Bros., Company Inc.  
Pulsation Dampeners—Fluor Corporation Ltd.  
Cooling Towers—Fluor Corporation Ltd.  
Silencers—Maxim Silencer Co.  
Valves—Nordstrom Valve Division.  
Tractors—Two Sterling Tractors, one with Cummins diesel engine and one with Hall-Scott.

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ssors  
ed with 370-hp Ingersoll-Rand gas engines, direct-connected  
provide air for starting, instruments, and utility use.







# Supervising & Operating Engineers Section

CONDUCTED BY R. L. GREGORY

## CRANKCASE EXPLOSIONS

### PART I

**THE SUBJECT** of crankcase explosions is one that we in the diesel industry have shunned through the years like a dreaded disease. While we know that such explosions do occur, we just don't like to harbor the thought of one and hold an antipathy against them like most people do the subject of the atomic bomb. But it does seem to the writer that this is the wrong attitude on the subject, since every plant in which diesels are operated is faced with the fact that such an accident could occur whether it has happened or not.

All power equipment is subject to accident and failure at one time or another. If designers had reached the point in making such equipment, where it was accident and fool proof, the casualty companies who insure our equipment would have to go out of business as they would no longer be needed. During the past few months we of the diesel industry have noted a couple of bad crankcase explosions, and while in both instances the results have been disastrous, these explosions have awakened many of us from our lethargy to the realization that such an accident could happen even in our plants. With this thought in mind, it seems a most appropriate time to discuss this subject in this section and to express our personal opinions and thus open a way for discussions and further information on a subject of vital importance to us.

Primarily the cause of a crankcase explosion, is the coming in contact with excessive heat, of the gaseous vapors of the crankcase mixed in the proper proportions. When these properly proportioned gases come in contact with excessive heat within the confines of the crankcase and explode, something has to give. Of one thing we are absolutely certain, that being that the conditions must be just right and that no explosion will occur in a normally operating unit, where no excessive heat is produced and where the mixture of these vapors is too rich to ignite. Realizing the fact that the mixture must be just right to ignite we further realize that by having an absence of oxygen or air, lessens the possibility of ignition, the gases being too rich to ignite.

Therefore we cannot agree with the minority of designers who feel that a crankcase should be ventilated by forcing air through it, which they claim will make the mixture too lean and drive the gases out, thus preventing accumulation of the proper mixture. Our thought is in conformity with the majority, who claim that the best solution of eliminating a proper mixture is by creating a vacuum in the crankcase and thus keeping the mixture too rich to ignite.

Of course this leads to the argument, that a crankcase must be perfectly sealed against the admission of air, which argument has its merits, since unless great care is taken with inspection doors, and other openings into the crankcase, there is a possibility of air seepage, and should the various types of breathers which are being installed on most units to maintain a vacuum, fail to function in maintaining that vacuum there is the possibility of enough air seeping in to allow the proper proportions of gases and air to form and thus set up the first requisite for a crankcase explosion, the second requisite of course being the excessive heat or hot spot to ignite the mixture.

Usually hot spots occur on a piston, at a wrist pin or bushing, or an overheated bearing. They are caused either by insufficient lubrication or cooling agent. The travel of the piston in the up and down stroke within the confines of the liner, creates friction or heat. This must be dissipated and carried off and is accomplished by two methods

First, in most types of large units, the lubricant is supplied to the walls of the piston and liner by means of lubricators, and copper tubes, connected to small ports (usually six around the liner walls). This lubricant forms a film on the piston and liner walls, which film must be maintained to decrease friction. The liner is also cooled by the cooling agent circulating through the system and to further aid in dissipation of heat, oil as a cooling agent is circulated through the piston heads.

Should either the lubricant cease to flow, or the cooling agent not circulate properly, the heat is

not dissipated and within a short time a hot spot is developed, and unless immediately corrected, you may have piston seizure. The same is true of the wrist pin, bushing or bearing which may get hot from lack of proper lubrication.

Another cause of a hot spot is moisture, although these cases are rare, but I wish to give a little experience which we encountered on one of our units, just as an example of what can happen. One of the operators noted on one of our units that the exhaust temperature of one of the cylinders was slowly rising out of proportion to the other cylinders. He checked the fuel pump, fuel rack setting etc., but could find no cause for the condition. We therefore transferred the load from this unit to another unit and shut down for further inspection.

What had really happened was, that a small crack had developed in the top of the liner (which incidentally had been in service about five years). This crack allowed a small amount of the cooling water to seep down the wall of the liner, thus destroying the lubricant on the liner wall at this particular point, and we were well on the way to developing a hot spot due to faulty lubrication, even though the lubricator was delivering a proper amount of lubricant to all ports. Of course it was necessary to install a new liner to correct the trouble.

We also had another experience which it might be well to relate since it is out of the ordinary. This one actually was the cause of a minor crankcase explosion, and I say minor, because while it did do a little damage, it was soon repaired and normal operation reestablished. This explosion was caused by a blowby, lubrication and cooling not entering into the picture, there being no actual hot spot, although there was excessive heat in the crankcase.

One evening shortly after supper, the operator in charge of this unit noted that we were getting a little blowby on No. 3 piston, and called my attention to it. This happened on a weekend and we had made arrangements to pull some of these pistons for inspection and re-ringing on the following day. Since the con-



dition did not seem too serious we decided to continue to operate the unit and remove it at the usual time of eleven p.m. About ten p.m. this minor explosion occurred and we immediately shut the unit down, put the auxiliary lube oil pump in operation, and turned the unit over for about a half an hour with the motor operated turning rig, thus giving the unit a chance to cool down and prevent any seizure if there was a hot spot.

The next morning we opened up this cylinder, pulled the piston and inspected it. There was no hot spot, no stuck rings and no broken rings, although the tension on some of the rings was pretty well gone. However the free gap on all six rings was in perfect alignment vertically on the piston head, and it appeared that when this piston had been in firing position, the flame of

explosion had followed right down the opening of the free gaps, until it had hit the vapors from the crankcase, which vapors had ignited and caused the explosion.

The two foregoing examples are rare instances that we have experienced and both being internal conditions within the engine itself, were not noticeable from outside, such as a stoppage of lubricant flow or insufficient cooling agent might be. These examples show conditions that may arise, and which can only be caught by vigilant operators who are constantly on their toes and checking their units while in operation.

I sometimes fear that too many of us just take things for granted once a unit is on the line. I have walked into many diesel plants and found the attendants anywhere except where they should

be—with their units. Once these conditions do arise, things can happen mighty fast and it takes an intelligent operator to locate and correct trouble quickly, before something does happen.

Manufacturers of diesel units, or in fact any type of power equipment can do their level best to eliminate such troubles by design, but if those in charge of the units do not do their part conscientiously these accidents will occur in spite of anything the manufacturer can do or say. Even with intelligent inspection and operation they do sometimes occur.

In next month's issue we will finish this discussion and give you means and ways that the diesel manufacturers are trying to prevent this type of accident and what you can do in your plants to decrease the possibility of such explosions.

### New Fairbanks-Morse Building in Chicago



A NEW building to house the Chicago Branch of Fairbanks, Morse & Co. was announced by R. H. Morse, Jr., Vice President in Charge of All Operations. The new structure, with the site, represents an investment in excess of \$500,000.00. The location is 1544-1558 South State Street. The new building will be of modern architecture of fire-proof materials, automatically heated and air conditioned. It will be one story, 145 x 250 feet, fronting State and 16th Streets and will house the sales and service personnel along with warehousing and

repair, facilities for the company's operations in the Chicago area.

Features of the office portion of the building will be in-the-wall filing cabinets, acoustical treatment of walls and ceilings, fluorescent lighting and base-board heating. Adequate trucking and parking facilities are included in the plans. Cranes will be installed for efficient handling of heavy parts.

### More Diesel Orders

Recent orders received by The Baldwin Locomotive Works include the following diesel-electric locomotives: four (4) 1000-hp. switchers for the Chicago, Milwaukee, St. Paul & Pacific Railroad Company; and three (3) 1500-hp. road switching locomotives and three (3) 2000-hp. heavy duty

transfer locomotives for the Duluth, South Shore and Atlantic Railway Company.

### District Manager for Diamond Chain



Howard W. King

DIAMOND Chain Company, Inc., Indianapolis, Indiana, announces the appointment of Howard W. King as West Coast District Manager with headquarters in San Francisco. Mr. King has a background of twenty-one years with Diamond Chain, the past fourteen years as district sales representative in Chicago.

## NEW METHOD OF REFUELING AND RESANDING DIESEL SWITCHERS ON PENNSYLVANIA RAILROAD

DEVELOPED and recently applied by Robert C. Welsh, Jr., Engineer in charge of coordination of all the Diesel facilities of the Pennsylvania Railroad, in collaboration with Walter Rebmann of Rebmann Company, tank manufacturers of Philadelphia and members of the staff of the Autocar Company, heavy-duty, truck manufacturers, this simple solution to the problem of refueling and resanding Diesel Switcher Locomotives without considerable loss of time, is now operating successfully.

The time element is of particular interest in the case of switchers as continuous operation is essential and economical, if it can be achieved. With passenger locomotives, refueling and resanding without loss of time is not such a difficult operation as train schedules necessarily provide a lay-over period at the end of each run during which replenishing and servicing may easily be accomplished. Had the problem been one of refueling only, it could have been relatively easily solved,

but the matter of resanding complicated matters.

It was necessary, therefore, to have a truck with a chassis that could convey adequate loads and yet have a wheelbase short enough to permit maneuvering in the limited spaces adjacent to railway switching yards and between some of the

Truck used by Penn R.R. for diesel switcher refueling and resanding.



tracks. Attention had also to be given to the legal weight limitations in the states covered by the Pennsylvania System.

The final design, of which sixteen units have been purchased by the Pennsylvania Railroad from the Autocar Company, has an all-steel, 1500-gallon, compartmented fuel tank with hose reel and truck-engine-actuated pump capable of discharging 50 gallons per minute. A conical pressurized sand container is mounted in the rear of the tank. It has a capacity of 20 cubic feet and is filled by gravity from the top. Two hoses are attached, one by which pneumatic pressure is applied from the Diesel which sand is forced at the rate of one cubic foot per minute.

By replenishing Diesel Switchers in the freight yards using these practical trucks, instead of sending them to bulk stations, a considerable increase in efficiency and economy of operation will be realized in the near future.



# High-Speed Diesels... Design, Operation & Maintenance

CONDUCTED BY H. G. SMITH

## Precision Bearings

**P**RECISION bearings are just exactly what the name implies, "Precision." They are carefully manufactured with some of the most highly developed accurate machines and fixtures and they must be installed with the same care.

Their accuracy can be easily destroyed by rough handling and inadequate installation instructions.

When you buy these bearings you have paid a premium for accuracy and if installed correctly they will provide the maximum bearing surface that can be obtained much better than the old method of line reaming or hand scraping.

Just recently the question was asked "To what extent does lead readings injure precision bearings."

Lead readings or checking the oil clearance with any type of strip is, in the first place, damaging, and secondly, unnecessary. These precision bearings are made to such close tolerances that the maximum variation of oil clearance obtainable is such that they always give an oil clearance within allowable tolerances.

Lead readings or strip checking is absolutely the wrong way to check oil clearances with precision bearings and should be avoided.

The proper method to follow is to check the diameter of the bore, in which the bearing is to be installed, and the diameter of the shaft and use the proper standard or undersize bearing necessary to obtain the oil clearance needed.

If it is desirable to determine the clearance existing on a new engine or worn bearings, use the same checking procedure outlined above and after removing the bearings check their wall thickness with ball end micrometers.

The reason that lead readings are not recommended is due to the fact that crankshafts do

H. G. Smith's background in diesel engineering renders his articles of great interest to those engaged in operation and maintenance of high-speed engines. From the Springfield, Ohio, Technical and Engineering school, he entered the Foss Gas Engine Company, Springfield and later, Springfield Motor Truck. With this experience behind him, he joined Hercules Motors Corporation where he was chief engineer for many years being with them when their diesel program was started. Executive engineer for Buda during the last ten years, he recently resigned to take up consulting work.



not wear uniformly in diameter. By turning the shaft into different positions you can get a dozen different readings.

If you are installing new shafts and new bearings, lead readings are not needed, but if you feel that you want to know the exact oil clearance, use the previously outlined procedure of measuring the bore, shaft and bearing thickness. With these measurements and a little addition and subtraction the oil clearance is obtained.

Any nicks, scratches, indentations or projections are definitely injurious to precision bearings whether they are copper lead lining or cadmium, cadmium nickel, babbitt, lead or aluminum. The softer materials are not injured as much as the harder copper lead because they will flow a little more and smooth out any projection.

If lead strips are used to check oil clearance and its thickness is greater than the oil clearance it will cause the surface of the bearing to bulge as illustrated in Fig. 1.

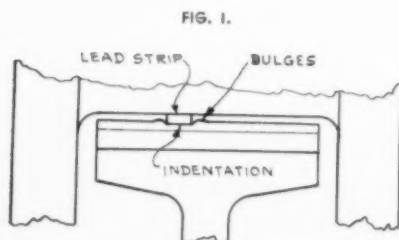


FIG. 1.

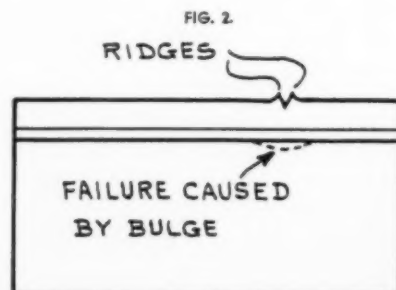


FIG. 2.

The bearing material will flow into small bumps around the strip. It may be only tenths of thousandths but it is still there.

The result is loss of bearing surface where the indentation occurs and high spots which may cause excessive heat and ultimate failure at these spots. The last is the most serious of the two.

If this happens, that is, "bulging," in a copper lead bearing, failure will definitely occur. Don't ever under any circumstances use strip readings on copper lead bearings.

Copper lead bearings are used extensively in diesel engines and they have proven to be an excellent bearing to carry the high loads imposed on them but they must be more carefully handled than softer materials such as babbitt, lead and the cadmiums. The copper lead will not flow, conform or level out like the softer materials. Any projections will keep their heads up and get hot and melt before they will give in.

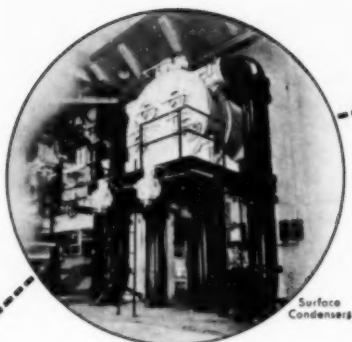
In one outstanding case the bearing failed because some one had used a scratch awl on the back of the bearing. A line had been drawn on the back for some unknown reason and the marking had caused a ridge to be thrown up on both sides of the line as shown in Fig. 2.

As near as could be determined later, the ridges were not over two ten thousandths of an inch. This was enough, however, to push the bearing out at this point and cause a high spot. The bearing failed in the same path as the line was drawn.

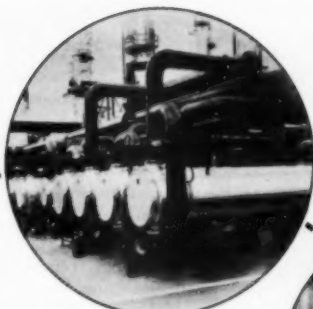
If it had been a babbitt or some other softer bearing lining the chances are that it would not have been so serious but the incident clearly demonstrated what may happen when the bearing surface is disturbed.

These precision bearings are usually packed in good strong protecting containers so as to prevent any possible damage in handling so when removing them from these packages be sure that they are handled in such a way that they are not scratched or marked.

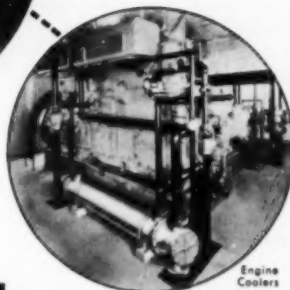
Many bearing failures are due to foreign matter getting between the back of the bearing and its mating bore. If this material is hard it will not crush down but push out the bearing.



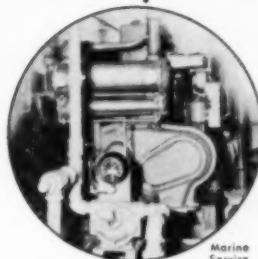
Surface  
Condensers



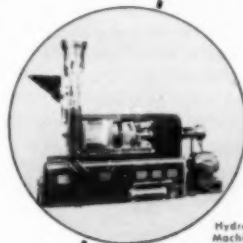
Refinery  
Exchangers



Engine  
Coolers



Marine  
Service



Hydraulic  
Machinery

## For Your Own Use, Or On The Machines You Make To Sell

**YOU'LL GET JOB-MATCHED PERFORMANCE  
FROM THESE STANDARDIZED EXCHANGERS**

For a big 27,000 sq. ft. surface condenser down to a little 2-inch oil cooler, Ross standardization today means new highs in job-matched performance and new lows in unit costs.

You may be outfitting a power plant, a petroleum refinery or a chemical plant requiring large capacity heat exchanger equipment . . . or you may be selecting smaller exchangers as accessories for the Diesels, compressors or hydraulic equipment which you use or make for sale to others. Neither the size, nor the type of service, nor the operating conditions present a challenge to Ross standardization . . . for Ross has standardized *successfully* on practically everything that is required in heat exchanger equipment.

This means, naturally, that the time-robbing, cost-mounting aspects of custom fabrication are avoided wherever Ross standardization suffices . . . and it more than suffices in most instances. But, where it doesn't, you still have available the industry-leading experience in special engineering and custom fabrication for which Ross has been known some 30-odd years.

# ROSS

## EXCHANGERS... MAKE OTHER PRODUCTS BETTER

★ **PREVIEW ROSS STANDARDIZATION** by requesting free Bulletin 4300, then review it with a Ross engineer who will gladly consult. ROSS HEATER & MFG. CO., INC., Division of American Radiator & Standard Sanitary Corp., 1425 West Ave., Buffalo 13, N. Y. In Canada, Horton Steel Works, Ltd., Fort Erie, Ont.

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# READY-MADE DIESEL DREDGES

By WILL H. FULLERTON

**T**HIS is the age, it seems, of waterways improvements, of the realization on the part of nations, states, municipalities and individual business of how much can be gained through full and proper use and development of the rivers and drainage channels that nature has provided. Hardly a river or harbor which is not undergoing some sort of a development project, either state or federal or perhaps some local real estate promotion digging a little channel to a yacht club or residential property. There is dredging going on simply everywhere where there is a river, creek, lake or seaport.

Getting hold of a dredge used to be something of a proposition. There never seemed to be any idle ones and many of these were too enormous to be moved about readily, too bulky to enter many of the small water alleys where dredging was most important of all. So many a state or municipality built their own, usually by the process of getting a naval architect to design the hull and specify the equipment, and then getting a shipyard to build the affair at a price within the apportioned tax receipts; kind of a lengthy process and as expensive as most individually designed and engineered jobs usually are. Still, what other way was there to buy a dredge?

Higgins, Inc., answered that one. This New Orleans organization at the war's end almost found itself all dressed up and no place to go. Its facilities included huge plants equipped to the last degree of efficiency, but to build what? Nobody needed any more landing craft, it seemed, yet the management hated to see these fine buildings and machines lie idle and so many skilled workmen idle. So Higgins, Inc., studied many possibilities and decided to give a play to the

waterways improvement angle. Here, with the billions planned for development and flood control not only in this country but in South America and other parts of the world, was some sure business for the immediate future and the corporation designers went to work.

One of the ideas they came up with was a stock hydraulic dredge, one that could be shipped anywhere. And as "anywhere" had to include areas that could be reached by rail or trailer as well as by ship, the dredge had to be constructed accordingly to these governing factors.

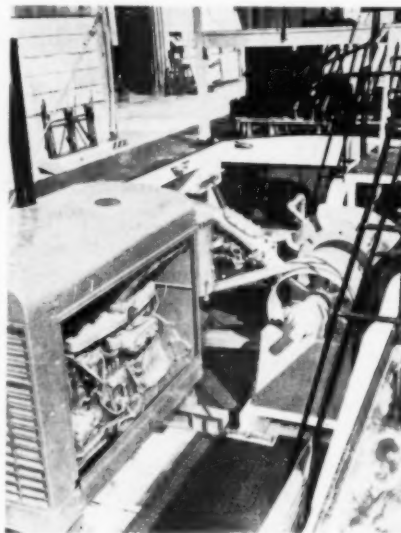
This Higgins dredge is a sectionalized deal. The hull measures 40' long, 16' 4" wide, with a draft of 5'. It can be shipped in one piece, or it can be built in five units; if so sectionalized, the center section or unit is 31' by 11', the other four sections all of the same size, 2' 2" by 20'.

All the machinery is contained in the center section, and all sections are drilled and provided with bolts to fit, the dredge can be assembled readily by workmen with no great degree of skill. The house for the controls, the ladder and spud gantry are all shipped demounted and not part of the outfit is so big as to prevent loading on a flat car or good-sized trailer.

Operating power is diesel. The 8" dredge pump is a Morris Machine Works type K sand pump, driven by a Buda diesel, DC 844, a six-cylinder engine from which 100 hp is taken for this job, with operation at 900 rpm. There are two other diesels aboard, both of these are Sheppards, 2 cylinder, 23 hp; one of these drives the cutter head, the other driving a 5-drum dredge hoist through a Foote Bros. speed reducer.

"We've found that there is a great need for simple, practical dredges, delivered ready to use," says Andrew J. Higgins, Jr., plant manager at the Higgins plant on the Industrial Canal, New Orleans, "and we've shipped dredges to many spots in this country as well as providing them for export to other countries."

This idea of a dredge, complete in one package, was a novel one; and one, incidentally, that probably could not have been satisfactorily put into execution without the existence of today's dependable small diesel engines.



(Below left) 40-foot Higgins dredge at work. (Below right) two 23-hp Sheppard diesels operate cutter head and dredging hoist. (Above right) Buda diesel supplies 100 hp at 900 rpm to Morris centrifugal pump.

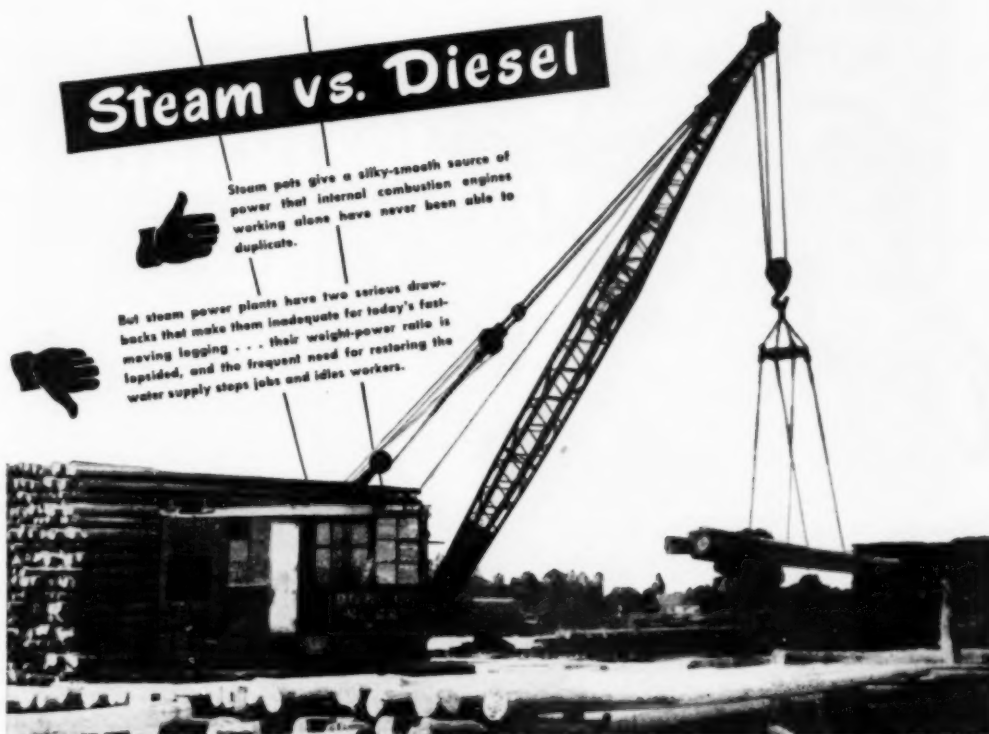




## Steam vs. Diesel

Steam pots give a silky-smooth source of power that internal combustion engines working alone have never been able to duplicate.

But steam power plants have two serious drawbacks that make them inadequate for today's fast-moving logging . . . their weight-power ratio is lopsided, and the frequent need for restoring the water supply stops jobs and idles workers.



## How to Get Steam Smooth Performance from a Diesel Engine

To combine the smooth power advantages of steam and the economy of Diesel power, Dierks Lumber and Coal Co., of De Queen, Ark., recently installed a Twin Disc Hydraulic Torque Converter (Lysholm-Smith type) in their 25-ton crane when they converted it to Diesel power.

The Orton crane now operates 16 hours a day with no interruptions. Except for a simple clutch lever on the torque converter, no original controls were added or changed. Besides providing steam power performance, the Twin Disc Torque Converter multiplies torque up to five times . . . enables the crane to push a 100-ton load with ease. Sluicing and road travel are smoother, faster, and there is less swing of the suspended load.

Ask your nearest Twin Disc dealer for details on converting steam to Diesel or gasoline power, or write Twin Disc today for Bulletin No. 135-C.  
TWIN DISC CLUTCH COMPANY, Racine, Wisconsin,  
(Hydraulic Division, Rockford, Illinois).



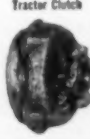
Hydraulic  
Torque Converter



Heavy Duty  
Clutch



Machine Tool  
Clutch



Tractor Clutch



Marine Gear

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918



**S**ATISFACTORY bearing performance in diesels is the result of intense study of operating conditions and expert engineering. Johnson Bronze engineers consider load, shock, speed, temperature, corrosive conditions and other service considerations before designing diesel bearings. They may recommend aluminum alloy bearings or tin or lead base babbitt on either bronze or steel backs . . . each type is best suited to certain conditions. Such thoroughness is more than justified by the unfailing performance of Johnson Bearings in the diesel field.

#### JOHNSON ENGINEERS

will gladly study diesel builder's requirements and make recommendations on the type and design of bearings needed. Write, wire or call for an appointment today!

**Johnson Bronze**  
SLEEVE BEARING HEADQUARTERS  
445 SOUTH MILL STREET • NEW CASTLE, PA.

Call JOHNSON BRONZE at ATLANTA • BALTIMORE • BUFFALO • CAMBRIDGE  
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LOS ANGELES • MINNEAPOLIS • NEW YORK • NEWARK • PHILADELPHIA • PITTSBURGH  
ST. LOUIS • SAN FRANCISCO • SEATTLE

#### Booklet on Flexible Metal Hose

A NEW brochure, Catalog 100 on flexible metal hose has just been released by the Atlantic Metal Hose Co., Inc.

Atlantic's product literature is designed to pass on to design, production and maintenance men, information relating to new uses for existing types of flexible metal hose; and development of new types of hose to meet problems encountered by Atlantic's engineering department.

Catalog 100 covers recent developments in interlocking and seamless hose as a flexible medium for such applications as diesel exhausts, conveying liquids, gases, solids and semi-solids; and in heat and pressure problems. The catalog is so organized that one can quickly find the hose, couplings, nipples, etc., needed. Test tables, installation methods and applications are included. Catalog 100 can be secured by writing Mr. W. D. Inman, sales manager, Atlantic Metal Hose Co., 123 West 64th St., New York 23, N. Y. Engineering consultation service is always available.

#### National Boat Show Occupying Four Floors in Grand Central Palace

THE 40th Annual National Motor Boat Show, which will be held in Grand Central Palace from January 6 through 14, will require all four exposition floors, it was announced today by George W. Codrington, president of the National Association of Engine and Boat Manufacturers, sponsors of the nautical extravaganza. This is the fourth consecutive year that the nation's oldest consumer-sports show will require all the available exhibit space in the Lexington Avenue exposition hall.

To date 198 applications have been received from boat, engine and accessory manufacturers, distributors and dealers. This is far in excess of the number of exhibitors allotted space last year at this time. The 39th annual show held last January had a record-breaking list of 238 exhibitors, an all-time high. The 1950 Boat Show is expected to surpass this number.

As in the past the main floor will feature cruisers, sailboats, inboard runabouts over 18 feet long, and heavy diesel engines. Exhibition space has been allotted to 14 cruiser and runabout builders and dealers, 11 sailboat builders, six diesel manufacturers on the main floor.

#### New Booklet by Meehanite

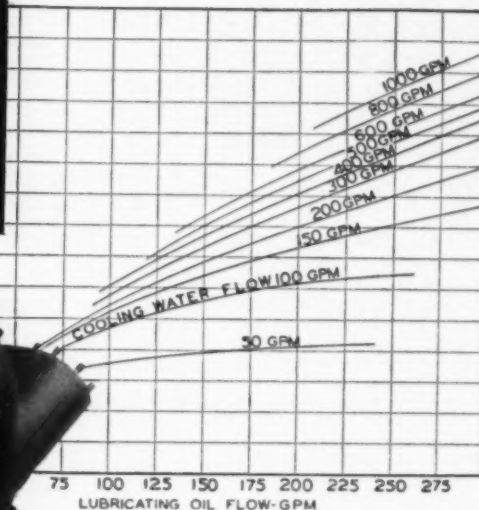
A COMPLETE tabular summary of the engineering properties of the various types of Meehanite castings available to industry is provided in a new four-page bulletin No. 32, issued by the Meehanite Metal Corporation, New Rochelle, New York.

The folder also contains data important to casting designers charting information concerning property changes as affected by variations in section sizes. A copy will be mailed free upon request.

# HARRISON OIL COOLERS



17500  
15000



**Diesel engine manufacturers depend  
on Harrison Oil Coolers for**

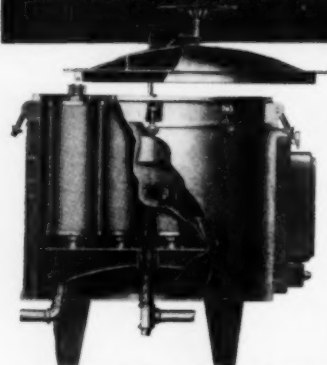
**SOUND ENGINEERING-RUGGED DESIGN  
EFFICIENT OPERATION**

**Consult Harrison  
on your cooling problem**

## HARRISON

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, N. Y.

## THE CHOICE OF MORE AND MORE ENGINE BUILDERS AND OPERATORS



### HOFFMAN FILTRATION EQUIPMENT

Designed to meet your needs . . . built to give you the service you want . . . with maximum economy and convenience of operation proved in scores of installations.

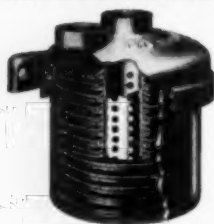
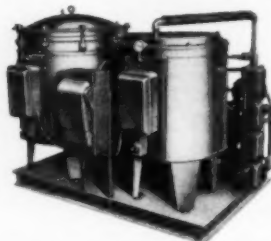
As buyer or builder of diesels, it will pay you to get complete details on the Hoffman filtration line. Literature and data are yours for the asking—TODAY.

#### HOFFMAN CARTRIDGE FILTERS FOR DIESEL FUEL AND LUBE OIL.

Feature a new high in modern, efficient design. An exclusive cover-lifting device simplifies cartridge removal. Swing bolts fasten the cover — assure quick, easy cartridge replacement. Available in two series, for either 7 x 18 Navy size throw-away cartridges in multiples of 1, 2, 4, 7, 9, 14 and 18 cartridges. Or, for 11 x 18 cartridges, either re-packable or throw-away types, in multiples of 1, 2, 3, 4, 6 and 8 cartridges. Provide continuous clarification on shunt or by-pass basis. With or without heaters and controls.

#### COMPLETE PURIFICATION OF USED LUBE OIL IN THE HOFFMAN OIL CONDITIONER

Save yourself the high maintenance cost of centrifuges. Removes both insolubles and solubles (oil, gas, moisture, fuel dilution). Only two moving parts . . . no steam or water connections. Models with capacities from 50 to 600 g.p.h.



#### HOFFMAN DISC FILTER

Three sizes of this compactly designed filter to handle 1 to 10, 5 to 50, and 50 to 125 gallons per minute. Removes impurities from 3 to 5 micro inches. Low first cost . . . no moving parts . . . minimum maintenance.

WRITE NOW for Descriptive Bulletins

#### FILTRATION ENGINEERING SERVICE...

For the right answer to your filtering problems, a Hoffman filtration engineer will survey your requirements and furnish recommendations based on detailed analysis of all factors. Ask for this service—There is no obligation.

# HOFFMAN

FILTRATION

DIVISION

UNITED STATES HOFFMAN MACHINERY CORPORATION

212 LAMSON STREET, SYRACUSE 6, NEW YORK

CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

### Diesel Engine Symposium

ILLINOIS Institute of Technology's department of mechanical engineering was host for a one-day diesel engine symposium October 27, 1949 on the Technology Center campus.

Purpose of the symposium, sponsored by the Diesel Engine Manufacturers Association, was to promote cooperation and coordinate activities of colleges and the diesel industry. The symposium was attended by representatives of colleges and universities within a 500 mile radius and is one of six being held throughout the country.

Hourly sessions followed a brief welcome by Dr. Henry T. Heald, president of Illinois Tech. Speakers and their subjects were:

"Fuels and Lubrication," J. A. Nelson, diesel engineer, Standard Oil Company (Indiana).

"Manufacturing Problems of Fuel Injecting Equipment," Nicholas Fodor, president, Diesel Engineering and Manufacturing Corps.

"Fuel Filtration Problems," C. N. Bentley, vice president, Deluxe Products Corporation.

"Silencers," R. L. Leadbetter, vice president, Burgess-Manning Company.

"Temperature and Flow Equipment," W. J. Bailey, engineer, Illinois Testing Laboratories.

The meeting concluded with a tour of the equipment, testing devices, and laboratories at Illinois Tech.

### Appointments at Elliott

C. H. HOSTERMAN, for many years manager of the Accessories Department, on September 1 was appointed manager of the General Apparatus Department. This department now handles sales of the accessories, heater, condenser, and ejector divisions. Mr. Hosterman came with Elliott Company from Pennsylvania State College in 1922.

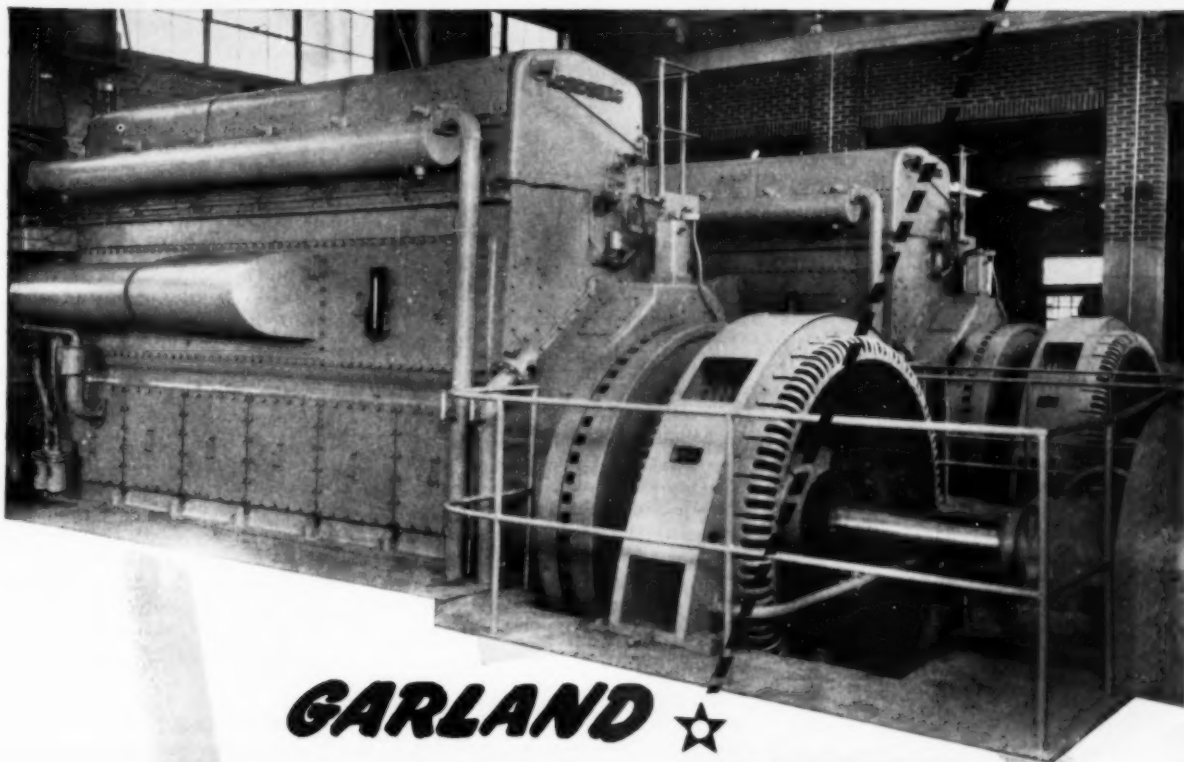
HARRY A. ERB has rejoined the Elliott Company as assistant to M. A. King, vice president in charge of engineering, with headquarters at the main plant of the company at Jeannette, Pa. Mr. Erb came with the Elliott Company out of Cornell University in 1928. He served as blower engineer, manager of the service department and manager of the electric power department of Elliott Company's Ridgway Division. For the past six years he has been steam turbine department service manager for Worthington.

### Booklet on Diesel Motor Trains

A NEW booklet, Diesel Motor Trains—An Economic Evaluation, is just off the press. Profusely illustrated and packed with more descriptive charts and graphs, this booklet covers the era from rail motor cars to motor trains. It continues to cover the experience of the diesel locomotive in other parts of the world as well as American experiences, and fully explains the economy of diesel operation to the railroad field. The problem of railroad passenger service is analyzed and the booklet concludes with the possibilities of diesel motor trains.



# **LOW COST POWER** *for*



## **GARLAND** ★ ... supplied by two **NORDBERG** **1220 h.p. Gas Burning DUAfuel ENGINES**

WHEN Garland, Texas, needed a big boost in power output, they followed the example of scores of other municipalities by installing two Nordberg 1220 H.P. DUAfuel Engines to gain the needed capacity. By burning natural gas or oil fuel, Garland now has the efficient combination of big engine power dependability together with the advantages of instant convertibility and proven operating economy.

The two 4-cycle Nordberg Engines at Garland are 6-cylinder, 16" x 22" super-charged units, each direct-connected to 855 K.W. generators.

Built in sizes from 10 H.P. to 8500 H.P., in a wide range of gas and oil burning types, Nordberg Diesels offer dependable power at low operating cost to meet almost all municipal and industrial needs. Write for further details, outlining your requirements.

**NORDBERG MFG. CO., Milwaukee 7, Wis.**

P1249



### Massey HP-1 Governor

THE MASSEY Machine Company has on the market its HP-1 Massey Hydraulic Governor with proportional control. The Proportioner allows a very fast first movement to grab the major part of the load change immediately, thus holding off speed to a minimum. It also allows turning the engine over to governor control in starting.

The Proportioner is a new and unique feature to hydraulic governors allowing a faster return to speed after a load change and holding the temporary off speed to less than before. Previously hydraulic governors were adjusted by a needle valve to their stable operating point and this frequently left the governor very slow in action. The Proportioner allows a fast movement to the new fuel position without sacrificing stability. The HP-1 governor is suitable for large and dual fuel engines.

### New Electro Products Laboratories Plant

THE NEW location at 4501 North Ravenswood Avenue, Chicago 40, Illinois, now provides improved manufacturing and servicing facilities under one roof.

These pioneer manufacturers of Electro battery eliminators for radios, have recently introduced a new type, higher rated DC Power Supply with conduction cooling to their complete line. Ex-

panded production facilities also offer improved delivery on the Pressuregraph and Syncromarker for accurate measurement and recording of dynamic and static pressures in engines and pumps and the Dynamic Micrometer for accurately measuring dynamic or static displacement vibration or movement of any metal body.

Spacious, sunlit display rooms are specially designed for displaying and demonstrating electronic instruments. A staff of factory trained technicians utilizing the latest, most scientific equipment offer a systematized, highly efficient service for quickly repairing electronic instruments.

Electro Products Laboratories' new plant is conveniently located and reached by trains, streetcar or bus.

### Patents Granted to International Nickel on New Cast Iron That Bends

INDUSTRY now has available to it a new cast iron which, unlike ordinary cast iron is not brittle but can be bent or twisted. This astounding new material can be made readily and economically and can be used in a myriad of applications, thus affording countless economies throughout the industrial world. It is probably the most outstanding metallurgical development in the foundry industry since around 1820 when Seth Boyden first made, from cast iron, the American type of malleable iron at Newark, N. J. The novel product, popularly known as ductile cast

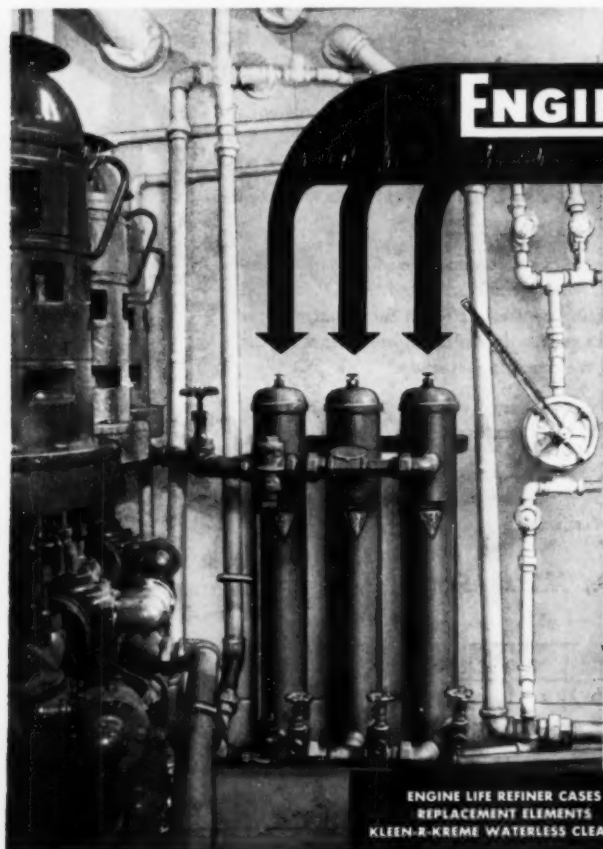
iron, has several times greater strength than ordinary cast iron with greatly increased ductility and shock-resistance.

These facts were presented today by Don Reese, well-known foundry expert and engineer, before the annual meeting of the Gray Iron Founders' Society, held at the Edgewater Beach Hotel, in announcing that the United States Patent Office has recognized the meritorious nature of these inventions by granting Patent Nos. 2,485,760 and 2,485,761 to the International Nickel Company.

### Laminated Shim Appoints New Plant Manager

GLENN H. ALBERGA has been appointed Plant Manager of the Laminated Shim Company of Glenbrook, it was announced today by Edward B. Nisbet, President. He will supervise all phases of the plant's production of shims, shim stock, stampings, and the patented lock nut, An-Cor-Lox. Mr. Alberga came to his new connection from the John J. Plocar Company, consulting management engineering firm of Stamford, Conn., where he has been General Manager and Chief Engineer for the past seven years.

Graduated as an electrical engineer from Cornell in 1926, Mr. Alberga is also a member of the American Society of Mechanical Engineers and a Director of the Greenwich Chapter of the National Association of Cost Accountants.



*For the life of your engine... use*

## ENGINE LIFE FILTER ELEMENTS

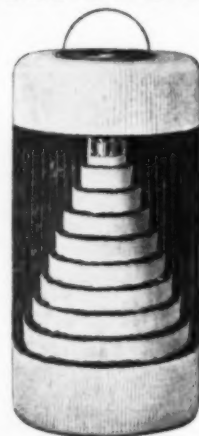
**...KEEP OIL CONSTANTLY CONDITIONED**

## MICRO-FILTRATION

Engine Life filter elements are unique in construction and the media used most carefully selected for the specific filtering job to be done always assuring free flow without channelling. The type and quantity of cellulose and/or long fibre textiles used are based on performance after exhaustive laboratory and field tests.

Abrasives, contaminants, acids, diluents and water are effectively removed without injury to the most modern of compounded oils.

The controlled density or porosity and the distinctive interbonded character of Engine Life filter media positively precludes migration of materials and removes by absorption and adsorption the injurious gums, varnishes and colloidal suspensions produced in internal combustion engines. Repeated cleansing insures "triple-trapping" or micro-filtration.



ENGINE LIFE REFINER CASES  
REPLACEMENT ELEMENTS  
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DISTRIBUTORS IN PRINCIPAL CITIES

# BACHARACH *Diesel Testing* INSTRUMENTS

## For Testing Compression Pressures of a Running Engine

Compression is measured by trapping the cylinder pressure by means of a check valve and measuring the pressure trapped above the check valve with a pressure gauge. Instrument is easy to connect to any make and model of Diesel engine merely by removing the injection nozzle or injector unit and installing the proper MOTORITE Adapter in its place. A large assortment of adapters is regularly carried in stock.



MOTORITE  
DIESEL COMPRESSION TESTER

## For Testing Firing and Compression Pressures at any Engine Speed

Suitable for any engine provided with an indicator connection or where any other cylinder opening may be used for installing the indicator (opening for glow plug, relief valve, etc.). Indicator provides a convenience in checking compression and firing pressures that no other method can match. Reads as high as 1700 psi, accurately, regardless of engine speed or firing rate.



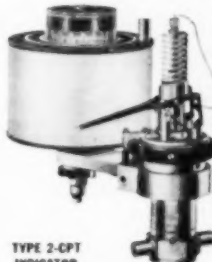
MODEL VHF  
INDICATOR

## For Testing Nozzles and Injectors



Designed to test accurately all types and sizes of Diesel nozzles and injector units. A large assortment of fittings and fixtures for convenient attachment of the injectors is regularly carried in stock. Push-button priming, automatic filtering of fuel, large fuel reservoir and precision manufacture are the reasons why this Nozzle Tester is preferred by Diesel engineers everywhere.

## For Pressure-Time Diagrams at Slow and Medium Engine Speeds



TYPE 2-CP  
INDICATOR

Eliminates need of indicator reducing motion for determination of m.e.p. and indicated horsepower. The pressure-time diagram also shows point of firing, ignition lag, rate of pressure rise after ignition occurs (burning rate) and compression and maximum firing pressures. Any Type 2-CP Indicator can be equipped with this Chronomatic Drum in the field.

## For Exhaust Smoke Measurements

A portable, easy-to-use instrument for Diesel exhaust smoke measurements. An electrically driven vacuum pump draws a measured sample of exhaust gas directly from the exhaust pipe and passes it through a disc of filter paper. The carbon soot deposited on the filter paper is then graded by comparing the soot discoloration on the test disc with the shading on a standardized comparator scale.



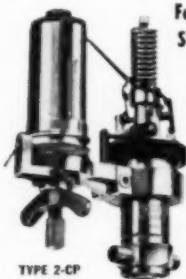
## For Pressure-Time Diagrams at High Engine Speeds

The only high-speed engine indicator available today for recording a complete pressure-time diagram in a single engine cycle. The diagram is traced on paper and is large enough for detailed study. A large assortment of pressure springs which are easily interchangeable, gives the advantage of great flexibility in the application of this indicator for test floor or field use.



TYPE 4-HST  
INDICATOR

## For Pressure-Volume Diagrams at Slow and Medium Engine Speeds



TYPE 2-CP  
INDICATOR

Type 2-CP is the standard card-drawing indicator for medium and moderately high speed Diesel engines. It is equally well suited for gas engines, compressors and steam engines. Convenient interchangeability of pistons and springs make it possible to adjust the indicator for any desired pressure range up to 2000 psi. A special model is available for recording pressures up to 15,000 psi.



### Nozzle Service Kit

This set includes the necessary tools for cleaning and general servicing of all popular makes of Diesel nozzles and injector units, all packed in a compact and convenient metal case.



### Indicator Valve

This Forged Steel Valve is designed specifically for indicator work. Notable features: straight-through passage, automatic atmospheric release, fast opening and closing.



### Indicator Diagram Converter

Mechanically converts pressure-time diagrams into pressure-volume diagrams. Adjustable for different lengths of P-T diagrams and for different connecting rod to crank ratios.

**BACHARACH INDUSTRIAL INSTRUMENT CO. - 7000 Bennett St., Pittsburgh 8, Pa.**



## Licking the Next Depression

**SALESMANSHIP**, not Government controls, is the key to future economic stability in the United States, Carlos D. Kelly, former banker and now vice-president of Purolator Products, Inc. of Newark, N. J., said in a talk on "How to Lick the Next Depression" before the fall meeting of Southwestern Automotive Wholesalers' Association at the President Hotel, Kansas City, Missouri.

Mr. Kelly, who is in charge of sales for Purolator, pioneer automotive oil filter manufacturer, pointed out to members of the Southwestern Automotive Wholesalers Association that real consumer purchasing power in 1949 is 50% above the 1940 level; that civilian employment is 12-

000,000 above 1940; that surplus income, over and above the increased cost of food and taxes, is 289% above 1940; that consumer debt is unusually low in relation to disposable income or individual savings; that there are over twice as many individual spending units with incomes over \$2,000 as in 1941; that productivity per capita is 34% above 1940; that individual savings are three times the 1940 total, and piling up three times as fast, and that inventories in manufacturing, wholesaling and retailing are 20% below the 1940 level, in relation to sales.

## Penn Announces Service Stations

**THE** establishment of a network of authorized service stations in all principal cities to provide

prompt, efficient servicing of Penn Automatic Controls has been announced by R. H. Luscombe, General Sales Manager of the Penn Electric Switch Co., Goshen, Indiana.

All Authorized Service Stations have been carefully selected, not only for their ability to meet Penn's requirements, but also for strategic location in relation to the service requirements of the area.

Service personnel in these authorized service stations are given an intensive course of factory training . . . instructed and supervised by Penn's service experts. This specialized training course is based on the design, construction and operating characteristics of Penn controls. In addition, all Stations are authorized to make immediate replacements under the terms of the Penn Warranty and also under the Penn Price Replacement Plan.

## W. A. Matheson, Jr. Joins Perfex



W. A. Matheson, Jr.

**C. E. LEWIS**, President of the Perfex Corporation, Milwaukee, manufacturer of automatic temperature controls and industrial engine radiators, announced that W. A. Matheson, Jr. (above) has been named Manager of their newly created New Products Division. In this capacity he will handle subcontracting for fill-in production and research for new products. Mr.

Matheson is a graduate of Lehigh University. He served three years in the armed forces, and most recently was Manager of Contract Sales for Williams Oil-O-Matic Division of Eureka-Williams Corporation.

## Less Wear With Diesel



**THIS** Model D-5 Ward LaFrance rig, powered with a 150 hp Cummins Diesel, accumulated more than 200,000 miles in the first two and one-half years of operations. The owner, W. C. Dalton of Mineral Wells, Tex., reports that during this period the only repair work necessary was the replacement of one set of piston rings and valve reconditioning. The rest of the engine showed little signs of wear.

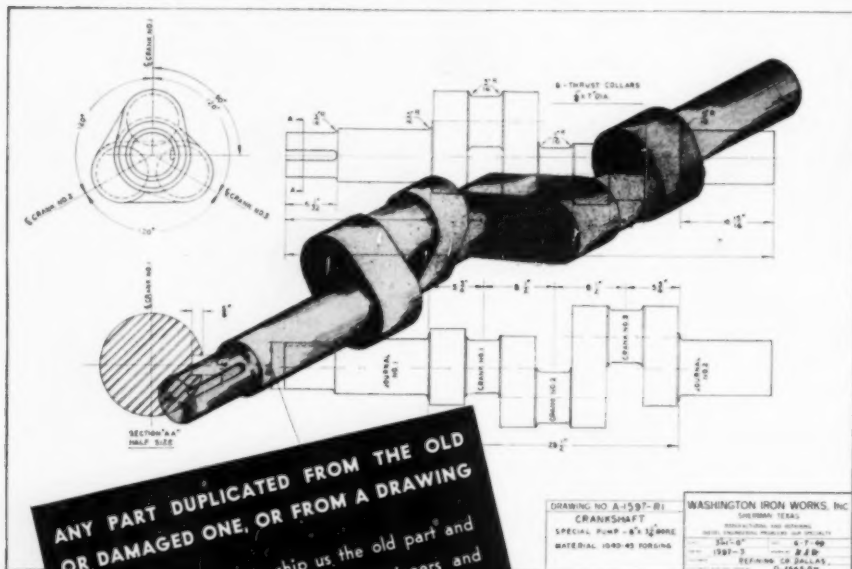
# BREAKDOWN need not be prolonged!

Illustration shows crankshaft from custom built pump in large Shortening and Soap Manufacturing Plant.

Original shaft failed in service and delivery time from factory was expressed in terms of **MONTHS!**

The broken shaft was received in our shops on **MONDAY**—drawings were prepared, work started and a completely new crankshaft—accurately machined from a solid forging—was ready for delivery the following **SATURDAY!**

Months of costly waiting reduced to **SIX DAYS.**



**ANY PART DUPLICATED FROM THE OLD OR DAMAGED ONE, OR FROM A DRAWING**

When not practical to ship us the old part and drawings are not available, our Engineers and Draftsmen will visit the location to prepare drawings and discuss repair procedures, when justifiable.

DRAWING NO. A-1597-B1  
CRANKSHAFT  
SPECIAL PUMP - 8" X 10" BORE  
MATERIAL 1040-45 FORGING  
WASHINGTON IRON WORKS, INC.  
SHERMAN, TEXAS  
REPAIRING AND REBUILDING  
SPECIAL MACHINERY FOR SPECIALTY  
1947-50 8" X 10" BORE  
REPAIRING OF PUMPS  
D. 4452-50

FAILURES OF OBSOLETE PARTS AND "OUT OF STOCK" ITEMS NEED NOT DELAY YOUR OPERATION.

CALL, WIRE OR WRITE

"KEEPING PACE WITH DIESEL PROGRESS"

# WASHINGTON IRON WORKS, Inc.

Established 1876

**SHERMAN, TEXAS**



# What type of air filtration do you need?

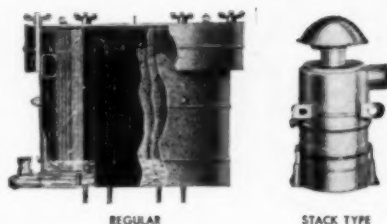
To meet the many different local conditions upon which filter selection depends, Air-Maze offers not one, but *many* types of air filters and filter-silencers. They're all engineered for specific requirements of performance, price,

weight, pressure drop, and space.

For the past 25 years, Air-Maze, *the filter engineers*, have been confronted by practically every type of filtration problem. The result is a wide choice of oil bath, panel, oil wetted and electric filters, as well

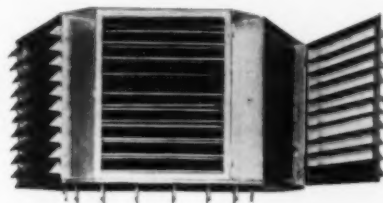
as silencers, to answer practically every Diesel engine air intake need. Some of the types available are shown below. For complete information contact your nearby Air-Maze representative or write Air-Maze Corporation, Cleveland 5, O.

## OIL BATH FILTERS



Available in sizes up to 6500 CFM with either bottom or top outlet. Low pressure drop due to cylindrical element. Continuous oil wash at all engine speeds. Special models with integral relief valves for compressors. "Stack Type" models up to 850 CFM.

## PANEL FILTERS



Available as individual cell units or complete plenum assembly ("DH" models). 60,000 CFM capacity. Your choice of filter cells possessing specific characteristics of pressure drop, efficiency, and dust-holding capacity. All metal, cleanable.

## OIL WETTED FILTERS



One of the lowest-cost air filters on the market. Cylindrical design provides large filter area in small space. All-metal screen mesh media can't channel or settle due to vibration. Can be mounted directly on intake. With or without all-weather hood. Up to 6000 CFM capacity.

## ELECTROMAZE



World's most easily serviced electric air filter. Cells slide in and out like desk drawers. Removes dust particles down to 1/10 micron. Exclusive monocyclic network power supply automatically compensates for normal line voltage fluctuations—provides complete protection against short circuits. Assembles like building blocks to meet most any space requirement.

AIR FILTERS  
SILENCERS  
SPARK ARRESTERS

**AIR-MAZE**  
THE FILTER ENGINEERS

LIQUID FILTERS  
OIL SEPARATORS  
GREASE FILTERS

## Atlantic & Danville RR Now Independent

**P**ROMISING a fast, efficient freight service for Middle Atlantic States' shippers, the Atlantic and Danville Railway recently resumed operations as an independent line after being under lease to the Southern Railway for fifty years.

Mr. E. L. Keister, president of the A&D, announced that, with completion of delivery of six new Alco-GE 1500-hp road switchers, a new nightly freight service would be inaugurated. The acquisition of the Alco-GE units, two of which were delivered in July, will make the A&D completely

diesel-electrified. Then steam locomotives now in use will be used for stand-by purposes only after the other units are delivered in October.

Weighing 115 tons apiece, the locomotives are 55 feet long and have a 39-foot wheel base. Power is supplied by a 12-cylinder, turbosupercharged American Locomotive Co. diesel engine. Tractive power is supplied by four G-E 747 motors geared to the axles.

### New Switcher by Lima-Hamilton

**L**IMA-HAMILTON CORPORATION has introduced a 750-horsepower diesel switching locomotive, in expanding its line of diesel switchers, and

has reported orders for two of these units from the Cincinnati Union Terminal Company. Delivery of the first of these is scheduled for December 1.

The new switcher, according to Lima-Hamilton, is, as nearly as possible, a duplicate of the company's 1,000-horsepower design, with maximum interchangeability of parts between the two models. All dimensions are the same, with the chassis, hood, and truck frames identical. The engine of the new 100-ton locomotive is a 6-cylinder version of the 8-cylinder in-line engine used in the 1,000-horsepower unit, with 9" by 12" cylinders, pressure charging, and inter-cooling of air between compressor and intake manifold. The engine of the new switcher is conservatively rated at 900 horsepower at 950 rpm. The new locomotive develops 750 brake horsepower for traction.

### Representative for Burgess-Manning

Appointment of Sample Brothers, of St. Louis, Mo., to handle sales of Burgess-Manning industrial and petroleum silencing equipment in the St. Louis territory, has been announced by W. L. Manning, Burgess-Manning Company president.

The St. Louis firm, selling industry, power plant, railroad and marine equipment, was started by Sam S. Sample in 1944. The partnership with his brother, Gus H. Sample, was formed in 1947.

Both partners are graduate engineers, with more than 20 years experience with prominent engine manufacturers, including Busch-Sulzer Brothers Diesel Engine Company and the American Locomotive Company.

Burgess-Manning manufacture exhaust snubbers, silencers and intake cleaners for internal combustion engines, compressors, blowers and vacuum pumps, as well as door-less sound absorbing telephone booths known as Acousti-Booths.

### Sales Agent for Lima-Hamilton



R. M. Close

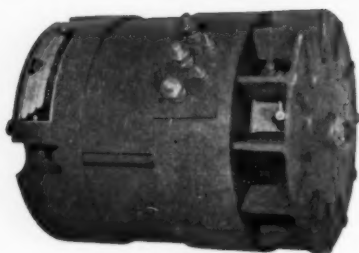
F. D. Ross, Jr.

**L**IMA-Hamilton Corporation, Lima, Ohio, and Hamilton, Ohio, announces the appointment of St. Louis Railway Supply Company, 2114 North Second Street, St. Louis, Missouri, as sales agent for Lima-Hamilton Railroad Products in the St. Louis Area. Messrs. F. D. Ross, Jr., and R. M. Close are principals of the company.

Products to be handled are diesel and steam locomotives, railway machine tools, snow plows and parts therefor.



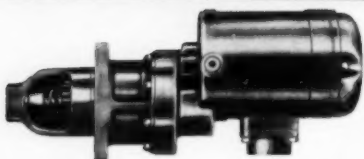
### A.C. GENERATING SYSTEMS



ALTERNATOR

(System includes Alternator, Rectifier, Regulator)  
14 Volt Systems - - - 60, 80, 100, 150 Amperes  
7 Volt Systems - - - 45 to 80 Amperes  
24 and 32 Volt Systems available soon

### AIR CRANKING MOTORS

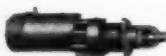


**AIR CRANKING MOTORS**—For safe starting of Diesel engines in presence of flammable matter or in combustible atmospheres. Economical and dependable in any application.

## DIESEL ELECTRICAL EQUIPMENT

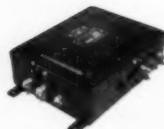
by  
**Leece-Neville**

### D.C. ELECTRICAL SYSTEMS



MOTORS

1/2 H. P. to 27 H. P.



REGULATORS

7 Volts to 37.5 Volts



GENERATORS

60 Watts to 2000 Watts



SWITCHES

7 Volts to 37.5 Volts



# LEECE-NEVILLE

Pioneer and STILL Quality Leader

**"When they saw the star,  
they rejoiced---"**

Matthew 2-10



**I**S not this, then, a season for rejoicing . . . a season for reviewing and re-appraising the priceless values we have enjoyed in this America? Among others, the eminent right of free enterprise . . . the right to work at or leave any job anywhere at any time. Shall we not agree that so fortunate a people must guard its heritage jealously? This land of ours challenges men against failure in any venture . . . its reward to men who work is a certain security . . . a certain freedom to think and to act together and as individuals for the greatest good to all the people of the world. Shall we look with sincere appreciation upon the gift we have so lately received from the valiant? . . . Shall we pause this Holiday Season to render to God our gratitude and to America our undivided loyalty so that there may be . . .

Peace on Earth to Men of Good Will.



## Central Engineering, Inc. Now "Vapor Phase" Representatives

ANOTHER forward step in "Vapor Phase" organization expansion is seen in the recent appointment of Central Engineering, Inc. of St. Louis as exclusive Sales and Service Representatives in the fifteen mid-continent states for Vapor Phase Engine Cooling and Waste Heat Recovery Systems, according to announcement by President L. C. Harbert of Engineering Controls, Inc., Los Angeles and New York.

Central Engineering, Inc. is under the capable direction of President Roger Brasfield, noted engine authority who has been active in the Diesel engine business in St. Louis for many

years. A complete "Vapor Phase" engineering and installation staff is maintained at Central Engineering headquarters, 2711 Olive St., St. Louis. An office has been opened in Kansas City and plans call for early establishment of additional sales and service offices in Tulsa, Chicago, Milwaukee, Minneapolis, Detroit, Cleveland, Indianapolis and other important centers to better serve the growing list of "Vapor Phase" dealers and users.

### Manager of Penn Chicago District

HOWARD C. SHILLING has been appointed manager of the Chicago district office, according to an announcement by R. H. Luscombe, general sales manager of the Penn Electric Switch Co., manufacturers of automatic controls for heat-

ing, refrigeration, engines, pumps and air compressors. He replaces E. M. Smith, former manager.

Shilling, an experienced sales engineer in the application of automatic controls, joined the Penn Co. in 1941 and covered the Chicago territory until he was appointed manager of the Moline district office. He also served as manager of the Goshen, Indiana, district before leaving the company in 1948 to enter the wholesaling field.

### Link-Belt Issues New Book



A NEW, 36-page illustrated Book No. 2065 on Link-Belt Silent Chain Drives for Automotive and Industrial Engines, Buses and Trucks, has been published by Link-Belt Company — and copies are now available for the asking.

Engineers will find the data in this book helpful in designing cam shaft drives for internal combustion engines, and in laying out efficient driving connections between all types of shafts, compressors, pumps, blowers, generators, etc.

The new book is complete with tables of dimensions, center distances, pitch diameters of wheels, horsepower tables, data for calculating chain drive centers, chain length required for drives, etc.

### Executive Engineer for Perfect Circle



R. H. Bancroft

RICHARD H. "Dick" Bancroft has been appointed as Executive Engineer of the Perfect Circle Corporation, according to an announcement made recently by corporation officials. Bancroft is assuming the position left vacant by the retirement of Macy Tector in September, 1946. Dan Tector, who

has been acting head of the Engineering Division since Macy's retirement, continues as Vice President and an active member of the Executive Committee.

Since last year, Bancroft, who has been with Perfect Circle since 1931, has been Castings Plant Manager for the corporation. In that position, he had charge of both the corporation foundry at New Castle, Ind., and the Corporation Sleeve Castings Plant at Richmond, Ind.

### Sales and Service Office for F-M

FAIRBANKS, MORSE & CO. announce the opening of a Diesel Locomotive Sales and Service Office for the Cleveland area. C. A. Mapp has been appointed District Sales Representative, and H. D. Buckner has been appointed Area Service Supervisor for diesel locomotives. They will be located in the Company's Cleveland, Ohio, Branch House, 2810 Superior Avenue.

Learning Your Clutch Needs	Improve Your Product FREE — With	Automotive and Aircraft
Analyzing the Problem		Trucks and Buses
Designing the Clutch		Tractors and Road Machines
Planning Production		Farm Machines and Implements
Tooling Up		Oil Field Rigs and Pumps
Manufacturing	<b>ROCKFORD CLUTCHES</b>	Industrial
Checking and Testing	<p>It won't cost you any more to specify the ROCKFORD clutch that is exactly suited to your product's power transmission control requirements—than to try to "get by" with one that only meets some of your needs. With an extensive range of clutch types and sizes to choose from, and a vast amount of experience-data to draw upon, ROCKFORD engineers can help your technical staff improve the power transmission control in your product, without adding to the cost. A request for a ROCKFORD engineered-to-the-job clutch transmission, for your product, will not incur any obligation.</p>	Mowers and Light Machines
Supervising Installation		Engines and Marine Units
Servicing		Machine Tools Production Units
		<p><b>ROCKFORD CLUTCH DIVISION</b> 3040 WARNER 1231 Eighteenth Street, Rockford, Illinois</p>



**DON'T BE SATISFIED  
WITH HALF-WAY MEASURES...**

**insist on  
Walseal® products  
and be certain**



**— the FACTORY INSERTED Ring insures FULL PENETRATION  
of the Silver Alloy ... a perfect joint**

Today, contractors ... builders ... architects are using brazed connections, in ever increasing numbers on their brass and copper pipe runs. However, they must be certain that the correct brazing alloy is used; that the joint has penetration of alloy up the shoulder of the fitting.

That's why more and more are turning to Silbraz® joints made with Walseal valves, fittings and flanges which assure the proper amount of alloy with no waste. They know that the finished joint not only will withstand hydrostatic pressure, but it will also withstand terrific impact and vibration — in fact, no correctly made Silbraz joint has ever been known to creep or pull apart under any pressure,

shock, vibration or temperature which the pipe itself can withstand.

Furthermore, it is a relatively simple operation to make a Silbraz joint — no heavy scaffolding need be erected ... just cut the pipe, flux, assemble, then braze, following the technique recommended by the Walworth Company. A silver brazing alloy — FACTORY INSERTED — in each port flows out when heated with the oxyacetylene torch, making a joint that is stronger than the pipe itself ... a one-hand operation, with the mechanic out of the path of the deflected heat — at all times.

*For full information about Silbraz joints made with Walseal products, write for Circular A-1.*

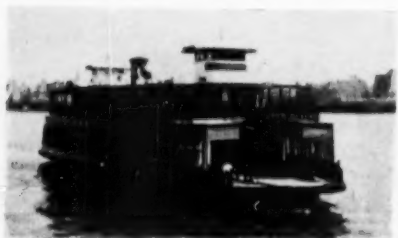
## **WALWORTH**

**valves and fittings**

**60 EAST 42nd STREET, NEW YORK 17, N. Y.**

**DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD**

## Diesel Propelled Ferryboat



THE Lackawanna, a Diesel-propelled ferryboat was put in service, September 6. Owned by the Lackawanna Railroad, the boat will ply between

Hoboken passenger terminal and Barclay Street, New York.

Originally the Chatham, the boat was remodelled and the Diesel-electric marine engine and other equipment were installed at the Brighton Marine Repair Yard, at West New Brighton, Staten Island. Work was started in November, 1948, and it was completed, August 31.

The Lackawanna's Diesel engine is rated at 1,350 horsepower and was manufactured by Electro-Motive. It is started by an electric motor, with pushbutton control similar to that in an automobile. Reversal of the boat's course is accomplished by turning a handwheel in the opposite direction.

The cooling system of the engine utilizes seawater. Originally equipped with a steam engine, the boilers were converted into storage tanks holding a three-weeks' supply of Diesel fuel oil. The capacity of the Lackawanna is 1,460 passengers. The boat was given a series of test runs, August 30, in New York Bay.

## New Mack 50-Passenger Diesel Bus



A NEW 50-passenger diesel powered Mack bus, embodying the latest in design features both from the operator and passenger viewpoint, has just been put into service by the Board of Transportation of New York City. Built by Mack at its Allentown (Pa.) bus plant to the specifications of Board of Transportation Commissioner S. H. Bingham, the new bus will be tested on all of the board's regular routes.

The Mack 4-cycle, 6-cylinder diesel engine which powers this bus produces 165 h.p. at 2000 r.p.m., with 480 lb. ft. torque at 1400 r.p.m.

The hydraulic torque converter with automatic shift at a predetermined speed from the variable speed hydraulic transmission to direct drive reduces the operator's effort to a minimum. To start, maintain speed and stop the driver has merely to use an accelerator pedal and a brake pedal—an important advantage in frequent stop service.

## Auto-Diesel Chief Tool Designer



Walter J. Herbut

Auto-Diesel is the only firm of its kind in Ohio, specializing in the manufacture of a wide variety of piston rings, seals and gaskets of both odd and standard sizes ranging up to 35 inches in diameter for industrial and automotive use, including marine, aircraft, locomotive, air pressure, hydraulic, steam and refrigeration machinery.

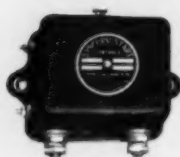
Herbut has been with Auto-Diesel 15 years, with prior experience in machine shop practice, cabinet making and as an assembler of record players. Smith explained that the promotion places Herbut in charge of tool design and development co-ordinated with the many special production and milling operations of the plant.

# RELAYS AND SWITCHES



The K R A Series of Relays contain a one inch Bulls Eye indicating light and a terminal for connecting to an alarm bell or horn to give a signal when either a battery circuit is closed or where it is grounded. Time delays can be included for either making or breaking a circuit or both. Commonly used to give a warning in case of low oil pressure or high water temperature on engines.

The Model "G" Series of Switches are operated by a centrifugal governor that will open or close circuits at any desired R.P.M. They have an adjustment range of approximately 20% increase or decrease of the R.P.M. requested and can be manual or automatic reset type. The centrifugal operating unit can be direct connected or driven by gear-belt or chain, when used with our angle drive adapter.



The Model "C" Series is a heavy duty contactor for closing starting motor circuits or any other circuits from some remote control switch, either manual or automatic. This contactor is the same used in conjunction with our Automatic Controls for closing of the starting motor circuit. Contact capacity at 6 Volts D.C. inductive load — 1200 amp. inrush — 450 amp. cranking.

Pressure—Temperature and Vacuum Switches. These are used for Pilot Switches to open or close a circuit at predetermined values and are adjustable within certain ranges. They are sealed and of very rugged construction. Snap action switches are used which are operated by a syphon bellows.



*Tell us what you need!*

**SYNCHRO-START PRODUCTS, INC.**

*Automatic Engine Control Equipment*

1046 WEST FULLERTON AVENUE, CHICAGO 14, ILLINOIS



## Announcing

a new series of  
**AUTOMATIC  
REVERSING VANE  
PUMPS**

Nos. 8021-8041-8101  
and Stripped Models,  
with or without housings.

FOR LUBRICATION SYSTEMS on machines and mechanisms that reverse. Pumps maintain unidirectional delivery regardless of direction of shaft rotation. Other advantages: easy changeability of flow direction from one port to the other; 4 different positions of foot mounting; stripped models for integral mounting. Write for new Bulletin. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

*We urge buying through the Distributor*

**BROWN & SHARPE** 

## ALARM SYSTEMS

STANDARD MODELS IN STOCK



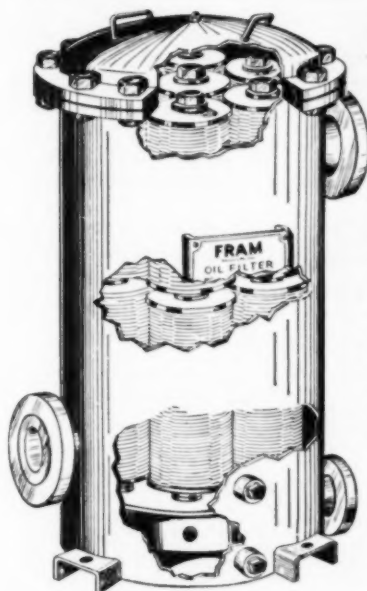
CUSTOM MODELS TO YOUR ORDER

*The* **UNION DIESEL ENGINE Co.**

2200 EAST SEVENTH STREET  
OAKLAND 6, CALIFORNIA, U. S. A.

## FRAM FILTERS Cut Costs...

## Extend Overhaul Periods



Read this 3 year performance record . . .

**AT** Springfield Bronze and Aluminum Co., Springfield, Mass., overhauls used to be required every 8000 hours on their 100 h.p. Diesel generator. Today, under the same grueling 24-hour running conditions, Fram Filters have extended overhauls to 20,000 hours.

### GOOD CONDITION

Previous overhauls showed piston rings in poor condition, all at least partially frozen. Lube oil was black, dirty, laden with contaminants. Since installing Fram, the last overhaul was made after 833 days of continuous operation. The general condition of the engine was very good with "blow-by" at a minimum.

### CUTS LUBE COSTS

The company calculated that the average cost of keeping lube oil clean to a .01 naphtha insolubles standard is 2 cents per hour, with oil change periods of 1000 hours compared to oil changes every 200 hours as previously required.

**WRITE TODAY . . .** Let Fram's Research Department help you determine how Fram Filcron Filters can give you lower operating costs and increased efficiency. You're sure of top performance because Fram Filters are *unconditionally guaranteed*. Write the Fram Corporation, Providence 16, R. I. In Canada: J. C. Adams Co., Ltd., Toronto, Ontario.

**FRAM Filcron**  
THE MODERN OIL FILTER

### DEMA's Marine Diesel Panel

THE Diesel Engine Manufacturers Association provided a Diesel Panel for the American Merchant Marine Conference during the week of their annual meeting in New York last month. The Panel was held at the Waldorf-Astoria and ran from 9:30 A.M. until Noon.

The program dealt with the application of diesel engines in the marine field. The meeting was called to order by Chairman, Robert H. Morse, Jr., of Fairbanks, Morse & Company and President of Diesel Engine Manufacturers Association. A group of prominent men in the diesel field spoke at this meeting which began with Paul A.

Christensen covering the subject on what is being done in Europe with diesel engines in cargo vessels; Capt. F. C. L. Dettman, USN, on the use of diesel engines by the Navy; Prof. L. A. Baier on the use of diesel engines on the Great Lakes and inland waterways; Stanley LeCourt, recent experiences with the operation of diesel vessels; Richmond K. Kelly on Tide Water's experience in operating diesel tankers.

### New Owners of Pickering Governor Co.

THE Pickering Governor Company, of Portland, Conn., oldest manufacturer of governors in the United States, has been acquired by the Henry &

Wright Division of Hartford-Empire Company.

Charles B. Taylor will continue as sales engineer of the Pickering line of mechanical and hydraulic governors. Effective Nov. 14, manufacturing and sales will be handled from Henry & Wright headquarters at 760 Windsor St., Hartford, Conn.

In announcing the purchase of Pickering customers, Henry & Wright officials stated that service would be continued as in the past plus the added engineering and manufacturing facilities of a larger and more completely integrated company. Henry & Wright has developed and manufactured an extensive line of high speed presses for continuous die work, as well as other special machinery. It is expected that the Pickering Governor line will be further developed and expanded as the engineering talents of its new owners are directed to it.

*"... 13 years' faithful, dependable service, frequently running 5-day stretches at full load!"*



With thousands of dollars in perishable fruit shipments arriving, Yonkers Fruit Company cannot take refrigerating chances. Under such conditions Mr. Alfred De Lello has for over 13 years depended absolutely on his Lister-Blackstone Diesel to deliver the same reliable, low cost service that it provides over its regular 8-hour work day.



**NEW REDUCED PRICES**

**GIVE YOU MORE DIESEL FOR YOUR DOLLAR!**  
3 to 300 H. P. Write us your requirements.  
Address Dept. DP.

**Lister-Blackstone**

INCORPORATED

Factory, Sales and Service Headquarters:

420 Lexington Avenue, New York 17, N. Y.

Parts Warehouses: MILWAUKEE, Wis., 3073 E. Chase Street • BOSTON, Mass., Whesco Building, Fish Pier

Agents in BOSTON • NEW YORK • NORFOLK • NEW ORLEANS • MOBILE • TAMPA • MIAMI • HOUSTON • NEWTON (Iowa) • SEATTLE • LOS ANGELES • SAN FRANCISCO • SAN DIEGO • MONTREAL • TORONTO • VANCOUVER • ST. JOHNS

Sold and Serviced in 37 Countries Throughout the World

### Truarc Charts for Seal and Shield Bearings

A SERIES of charts giving engineering data and specifications for use of Waldes Truarc Inverted Retaining Rings (internal type #5008) with seal and shield bearings, is now being made available by Waldes Kohinoor, Inc.

The Truarc Inverted Ring is specially designed to provide a uniform protruding shoulder thereby making it especially suitable for use in positioning and retaining seal and shield bearings within a housing.

Specifications include groove diameters and widths, and all other pertinent data. A complete set of charts covering Fafnir, Federal, Hoover, New Departure and MRC Seal and Shield Bearings may be obtained without obligation. Write Waldes Kohinoor, Inc., Long Island City 1, N. Y., Department TR58.





# STANDARD ENGINEER'S REPORT



## TEST DATA

LUBRICANT	<i>RPM DeLo Supercharged Lubricating Oil</i>
UNIT	<i>Caterpillar Diesel-D17000-V8 Cyl.</i>
CONDITIONS	<i>Cont. High Load-Actual field oper.</i>
FUEL	<i>Commercially available Diesel Fuel</i>
TEST PERIOD	<i>4 months</i>
FIRM	<i>Homer Jones Ranch, Chandler, Ariz</i>

## NEW LUBRICATING OIL

### STOPS ALL RING STICKING WHERE ORDINARY OIL FAILED

Specially Developed RPM DELO Supercharged Oil Solves Extra Tough Load and Carbon Problems



AFTER ONLY 625 HOURS operation on an ordinary heavy-duty type oil, an engine pulling 90% of full load rating had 39 stuck rings — only 9 of its 48 rings were free and several were broken. There were heavy lacquer and carbon deposits in ring grooves and on piston-skirts, as indicated by this unretouched photograph of one of the pistons. Besides stuck rings, note clogged oil-return holes and oil rings.



OPERATED 1582 HOURS — more than twice as long — on RPM DELO Supercharged Lubricating Oil, the same engine, running under the same load and fuel conditions, stayed efficient and clean, as this unretouched photograph shows. At the end of test all 48 rings were free, there were no piston-skirt deposits, ring-groove deposits were 50% less. Note how RPM DELO Supercharged kept oil-return holes open.

**REMARKS:** RPM DELO Supercharged Lubricating Oil is a new product added to our line. It solves operating problems in both Diesel and gasoline engines, especially where load conditions are extreme.

Its detergent prevents carbon and lacquer deposits on all parts, even with high sulphur-content fuels.

RPM DELO Supercharged Oil sticks on hot and cold surfaces — reduces wear under the heaviest loads. (Cylinder-wear averaged only 0.0014 inches per 1000 hours with RPM DELO Supercharged, while with the ordinary oil it was 0.0043 inches — three times greater.) RPM DELO Supercharged Lubricating Oil also contains special compounds that resist oxidation and sludging, prevent bearing corrosion and internal rusting, and stop foaming.

**STANDARD TECHNICAL SERVICE:** checked and reported this test. If you have a lubrication or fuel problem your Standard Fuel and Lubricant Engineer or Representative will give you expert help; or write Standard of California, 225 Bush Street, San Francisco 20.

STANDARD OIL COMPANY OF CALIFORNIA • San Francisco  
THE CALIFORNIA OIL COMPANY • Barber, N. J., Chicago

STANDARD OIL COMPANY OF TEXAS • El Paso, Texas  
THE CALIFORNIA COMPANY • Denver, Colorado

# THOMAS

*Flexible* ALL METAL  
**COUPLINGS**  
FOR POWER TRANSMISSION  
REQUIRE NO MAINTENANCE

**Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.**

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:

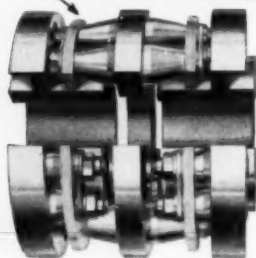
1/2 to 40,000 HP  
1 to 30,000 RPM

**Specialists on Couplings for more than 30-years**



PATENTED FLEXIBLE DISCS

**BACKLASH FRICTION WEAR and CROSS-PULL are eliminated**  
*Lubrication is not required!*



THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT.

NO MAINTENANCE PROBLEMS.

ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

Write for the latest reprint of our Engineering Catalog.

**THOMAS FLEXIBLE COUPLING CO.**  
WARREN, PENNSYLVANIA

## Activated Cutaway Model of Cummins Diesel

EQUIPMENT owners, operators and power engineers are having a better opportunity to study the mechanical features of a powerful highspeed diesel through an activated cutaway version of the new 550 hp Model NVHS-1200 Cummins diesel being displayed by Cummins Engine Company, Inc., Columbus, Indiana at the various expositions and trade shows throughout the country.

A center of interest at the American Mining Congress show at Cleveland in May, and at the first National Truck and Trailer Show in Los Angeles in June, the activated model NVHS-1200 is beginning a tour that will carry it to all parts of the United States and Canada as a feature of the Cummins exhibit at all leading industrial shows.

The cutaway version of the Model NVHS-1200 has been sectionalized to show clearly the internal structure and operation of the following units: the exclusive Cummins Fuel System, including the new DD (Double Disc) type pump; cylinders and liners; valves; pistons; supercharger and supercharger drive; gear train; water pump; oil cooler; lubricating oil pump; oil pan; crankshaft; camshaft; and the four-cycle principle of operation. All portions of the engine which were sectionalized have been replaced with lucite, and the engine is internally lighted and activated.

## Changes at Morse Chain

WALTER M. REYNOLDS of Dearborn, Mich., has been elected secretary of Morse Chain Co., a division of Borg-Warner Corp. Reynolds also retains his post as controller of the division, which operates plants in Detroit, Ithaca, N. Y., and England.

The duties of treasurer of Morse Chain have been assumed by R. P. Johnson, the First Vice President. The positions of secretary and treasurer now filled by Reynolds and Johnson were formerly combined in one office held by the late Stanley B. Waring of Ithaca.

Reynolds was controller of the Hughes Tool Co. of Houston, Tex., prior to joining Morse Chain Co. He also has been assistant treasurer of Curtiss-Wright Corp., and treasurer and controller of William Sellers & Co., manufacturers of machine tools. He was graduated in 1927 from New York University. Since 1928 he has been engaged in accounting work and has specialized in organizing accounting and cost departments.

## Paragon Offers Special Die Spring Assortment

TO meet the requirements in general shop applications and experimental departments, the Paragon Spring Company of Chicago has just announced their new S-27 Die Spring assortment. According to the announcement, the assortment includes 27 surface-stressed die springs, 11 inches long overall, with plain ends, to fit holes from 7/16" to 1-9/16" and fit rods from 1/4" to 15/16". A bulletin describing this complete assortment is available on request to the manufacturer at 4615 West Fulton Street, Chicago 44, Illinois.

## New Chief Engineer For Twin Disc



Lloyd Wolf

He received his academic training at the University of Michigan and Wayne University, Detroit.

APPOINTMENT of Lloyd Wolf as Chief Engineer in charge of the Twin Disc Clutch Company's Engineering Department at Racine, Wisconsin has been announced by N. F. Adamson, Vice President.

Mr. Wolf joined Twin Disc in July, 1947, as Chief Development Engineer.

During the war, Mr. Wolf was Chief Engineer of Army Ground Forces, Board No. 2, at Fort Knox, Kentucky, where he was primarily concerned with the development of hydraulic power transmissions for the Army's heavy tank program. Previously, he was associated with Gemmeck Manufacturing Company, Mechanical Handling Systems, Continental Motors and General Motors Corporation in engineering capacities.

## Federal Adopts Hercules Heavy-Duty Diesel



ROGER BURLEY (right), assistant to the president of Federal Motor Truck Co., points out features of the new series D45 Diesel engine adopted for its heavy-duty trucks, to assistant general sales managers W. L. Hayes (left), eastern zone, and H. J. Hamernik, central zone. The engine, of Hercules design, develops 142 horsepower at 2,600 RPM and has a gross torque output of 332 ft. lbs. at 1,700 RPM. Fuel savings up to 50 per cent have been recorded in operational road tests with the unit. It weighs only 485 pounds more than a comparable gasoline power plant.

## Vice-President for Dravo Corp.

DRAVO CORPORATION, Pittsburgh, announces the election of Mr. Charles E. Walker, Jr., as Vice-President. Mr. Walker will continue as Secretary and Director of Industrial Relations of Dravo Corporation, which positions he has held since September 1944.

Mr. Walker joined Dravo in 1933 as a member of the Accounting Department. He successively held positions of Assistant Secretary, Assistant Treasurer, Assistant Auditor and Auditor, when at the beginning of expanded war activities he was designated as Assistant to the President in February 1942. He has been Director of Industrial Relations for the past four years.

designed for  
carefree performance...



That's why it  
pays to specify  
**TUTHILL**

**GENERAL PURPOSE PUMPS**

- Low first cost • Negligible maintenance • Compact design • Operates dependably in either direction of rotation • Capacities to 200 g.p.m. • Pressures to 100 p.s.i. • Direct drive, slow-speed V-belt units and stripped models

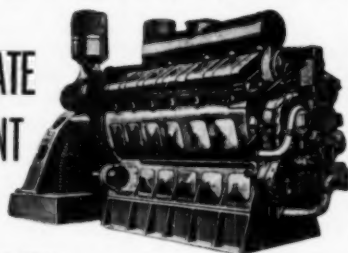
Write for Model C bulletin.

**TUTHILL PUMP COMPANY**

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**DIESEL POWER PLANTS**

FOR  
**IMMEDIATE  
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**UNIT CAPACITIES  
10 TO 1420 KVA**

**A.C. 50 AND 60 CYCLES  
VARIOUS VOLTAGES**

Write or wire today for bulletins and complete information regarding these fine fully guaranteed low-cost **DIESEL ENGINE GENERATING UNITS**. Visit our plants at Sausalito (S.F.), Cal. or Jersey City, N. J. and see units in operation on our test stand.

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54 CHURCH STREET NEW YORK 7, NEW YORK

Plants and Warehouses: Jersey City, N. J., Sausalito (S.F.), Cal.

**New Diesel Booklet**

Mail coupon  
for your  
**FREE** copy.



... Shows How  
**You Can Save  
3/4 of Your  
Power Bill**

**GIVES ALL** the latest information on Sheppard Diesel power units (3.5 to 100 H.P.) and generating sets (2 to 36 K.W.).

**DEALERS**—There's a big market for Sheppard Diesels. That means quick profits for Sheppard dealers. Mail coupon for details.



**SHEPPARD DIESELS, Hanover 8, Pa.**

I want to save 75% on power costs. Send **FREE** booklet.

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**AUTOMOTIVE • STATIONARY • MARINE**

**DIESEL'S THE POWER ... Sheppard's THE DIESEL**

**KEEP COOL AT 2300°F**

You can maintain comfortable working conditions for personnel regardless of diesel exhaust temperatures and solve vibration problems as well. Use Atlantic's **Interlocking Double Insulated Exhaust Hose** which combines an inner hose wrapped in asbestos, an outer hose, and a dead air space between. For extraordinary exhaust conditions, use Atlantic's **Interlocking Water Jacketed Exhaust Hose**. **Seamless Steel Hose Type SW** is an all-purpose diesel hose famous for exhaust and vibration control.

For Large Installations



**Double Insulated Exhaust Hose**  
For Fuel Oil Lines — Lube Oil Lines — Water Lines — Air Lines — Steam Lines — specify Atlantic **Seamless High Pressure Hose with Braided Wire Jacket Type A-1**. Bronze, steel or stainless steel according to application. Sizes 1/8" - 26" I.D. inclusive. Standard or special couplings, fittings, flanges, nipples. With or without braid or armor.



**Type SW Diesel Exhaust**—Furnished straight or bent to blueprint.

Write for Diesel Bulletins 1020 & 504

**Atlantic Metal Hose Co., Inc.**  
102 West 64th St., New York 23, N. Y.





# GUN IRON PISTON RINGS

DOUBLE SEALING  
ACTION  
DOES THE  
WORK OF  
2 RINGS



SEALS IN BOTH DIRECTIONS

**HUNT • SPILLER**

*Double-Acting*

PISTON RING

FOR AIR PUMP AND  
COMPRESSOR PISTONS

*Outlast*  
**OTHER RINGS**  
*8 times*

**...and still going!**

A railroad company installed Hunt-Spiller double-acting piston rings in each of four pistons in a steam operated air pump (2 pistons for steam - 2 for air). Piston rings were normally replaced every nine to twelve months but the

Hunt-Spiller rings, of Gun Iron, are still going strong after eight years. Gun Iron is performing equally well in other types of Hunt-Spiller rings for hundreds of different uses.

## What is GUN IRON?

You'll find all the answers as well as valuable information on other metals and alloys in this interesting metallurgical bulletin. Write for it on your company letterhead. No obligation, of course.



Wherever cast parts must withstand frictional wear, high heat, pressure or impact, Gun Iron excels. During the past 139 years its resistance to these conditions has been proven on thousands of applications in the railroad, marine, diesel, petroleum and metalworking fields. In addition, Gun Iron castings can be relied upon for uniform performance because their physical properties are completely controlled at Hunt-Spiller . . . Gun Iron, and its alloys, are produced in our own air furnaces, cast in our own foundry and when desired, can be completely machined in our manufacturing plant.

If you have cast wearing parts in your product, it will pay you to investigate Gun Iron. Our engineers stand ready to assist you in its application . . . our plant facilities are geared to produce your parts, from raw material to finished part, both accurately and economically.

DESCRIPTIVE BULLETIN AVAILABLE ON H-S DOUBLE-ACTING PISTON RINGS



**HUNT • SPILLER**

MANUFACTURING CORPORATION

387 DORCHESTER AVENUE • SOUTH BOSTON 27, MASS.

Canadian Representatives: Joseph Robb & Co., Ltd., 4050 Namur St., Montreal 16, P. Q.

## New Factory Representative for Lister Blackstone



**Capt. R. M. Ellis**, D.S.O., R.N. (Retired), recently became British Factory Representative in the U.S.A. and Canada of the Lister and Blackstone group of Companies, and is also acting in charge of U.S.A. sales and service for Lister-Blackstone Diesel Engines, including those built in this country, according to a recent announcement by Walter K. Davies, President of Lister-Blackstone, Inc., of 420 Lexington Avenue, New York City, wholly-owned subsidiary of the world-famous diesel manufacturers, R. A. Lister & Co., Ltd., of Dursley, England.

Mr. Davies said it was significant from the standpoint of Lister-Blackstone engine users that Captain Ellis' career and experience had largely paralleled the world wide development of diesels, and that he had long been shipmates with Lister and Blackstone installations afloat. Mr. Davies highlighted this by remarking that Captain Ellis was Assistant Chief of Combined Operations to Admiral (then) Lord Louis Mountbatten, and subsequently Director of the Combined Opera-

tions Division at the British Admiralty, throughout the period of Allied landings in North Africa, Italy, and France, which as is well known were made in vast numbers of diesel-powered ships and craft specially developed for the purpose.

On retirement from the Navy, Captain Ellis spent some time in Birmingham (the center of British heavy industry) with a foremost manufacturer of automotive and motor craft electrical equipment, in a working study of their very large servicing organization. He then proceeded to the Lister and Blackstone Factories where he studied their production operations, until ready to transfer to the U.S.A. His headquarters is now the New York Office of Lister-Blackstone, Inc., where plans are being made for expanding Lister and Blackstone business in America, which has been established here for over forty years. He is also connected with the Canadian Company which only last year installed Lister-Blackstone Auxiliary Engines to the value of nearly half a million dollars in Canadian-built vessels.

## DEMA Conducts Educational Symposium At American Bosch

A DIESEL engine educational symposium, sponsored by the Diesel Engine Manufacturers Association, was held at the American Bosch Corporation in October. This interesting meeting consisted of a complete tour through the American Bosch plant and laboratories with explanations

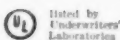
of each department given to the individual groups by informative, congenial, trained men of American Bosch. After the morning trip, the initial session was called to order by chairman Ray Vaughn.

Welcome and opening remarks were given by Donald P. Hess, President of American Bosch, and Foster N. Perry, Vice President. The educational meeting began with a paper given by Howard Boyer that covered the subject of Metallurgical Control. This was followed by three more papers: Application of Fuel Injection Equipment, by Walter Gewinner; Governing Diesel Engines, by John Broderick; Laboratory Test Equipment, by Paul G. Burman.

The second portion of the plant tour that followed luncheon covered a great part of American Bosch's laboratories. Four papers were given in the concluding session that covered the following: Turbine Injection Pump, by C. H. Nystrom; Standardization of Fuel Injection Equipment, by Sumner L. Young; Fuel Injection Equipment for Dual Fuel Engines, by Fred DeLuca; Cost Considerations of Diesel Engine Fuel Injection Equipment and the PSB Fuel Injection Pump, by Hans Hogeman.

Diesel Engine Catalog is just off the press in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 67.

**CUT "down time"**  
**REMOVE SLUDGE and DIRT**  
**from SUPPLY LINES with**  
**KRAISSL SEPARATORS**



**SINGLE  
AND  
DUPLEX  
UNITS**

**BOTH  
STANDARD  
AND HIGH PRESSURE OPERATIONS**

Kraissl's Separators are designed and engineered to give maximum, economical protection to every supply line on diesel installations, including cooling water. Any practical degree of separation—from primary straining to secondary filtration. With Kraissl Separators, you entirely eliminate your normal filter replacement costs. Baskets are instantly—and easily—changeable. No tools are needed. Magnet equipped baskets available for lubricating lines—and other installations, where metallic particles are a source of trouble.

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**Massey**  
**GOVERNORS**

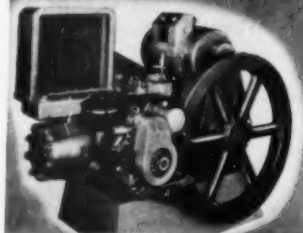


**NEW** Type HP-1 Isochronous Governor with Proportioner Control

Write for Catalog H-149

**MASSEY MACHINE CO.**  
GOVERNOR BUILDERS FOR OVER 40 YEARS  
783 PEARL STREET WATERTOWN, N. Y.

**WITTE** Small-Diesel Pioneers



Witte Dieselelectric Plant Model DLREA

**TWO NEW, LARGER  
WITTE  
DIESELECTRIC PLANTS**

• Here's good news for electric power users. Witte announces two new and larger Dieselelectric Plants, built for the same low-cost, trouble-free performance that has given smaller Witte units their world-wide reputation.

Largest of the new Witte Dieselelectric Plants, Series DO, is rated up to 25 KVA-AC or 20 KW-DC. Series DL develops 17.5 KVA-AC or 14 KW-DC. Both plants include a single-cylinder, horizontal Witte Diesel Power Unit and a belt-driven generator. Gasoline starters assure power the instant you want it.

These new units are designed to bring the advantages of Witte Dieselelectric Power to installations requiring up to 20,000 watts without the necessity of synchronizing two smaller plants.

We'll be glad to send you complete information on these new Witte Dieselelectric Plants, as well as on smaller units providing 3 to 10 KVA-AC; 2.4 to 8 KW-DC.

**WITTE ENGINE WORKS, DEPT. 7-12,  
KANSAS CITY 3, MO., U.S.A.**

Division of Oil Well Supply Company



**WITTE DIESELECTRIC PLANTS  
AND DIESEL POWER UNITS**

**UNITED STATES STEEL**

## STEP UP DIESEL MAINTENANCE

WITH THIS  
**FASTER,  
FINER PRECISION**

### DIESEL TYPE VALVE SEAT GRINDER

THE  
WATERBURY  
HALL  
MODEL EDP

Keep more stock rolling, with less need for overhaul, with the Waterbury-HALL EDP Diesel Valve Seat Grinder. Operating on the eccentric grinding principle — for faster, finer finishing — the EDP grinds to factory precision, even in the most unskilled hands. A time-saver that does a better job, it's a quality tool no maintenance manager should overlook.



Get the complete story on the Waterbury-HALL EDP and accessories. Be convinced. Write the factory direct. Ask for Forms 3F-73 and 3F-854.

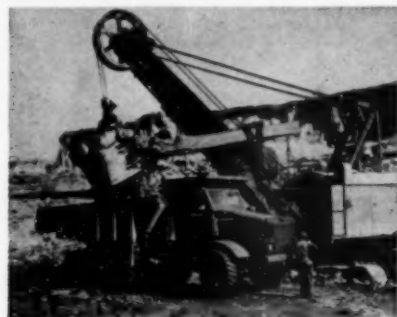
THE LINE OF LEAST RESISTANCE  
WATERBURY-HALL

## WATERBURY

### WATERBURY TOOL

Division of Vickers Incorporated  
2012 EAST AURORA STREET  
WATERBURY 91, CONNECTICUT

### Two GM Diesels Teamed With Torque Converters Power New Euclid 1-FFD



THE new model 1-FFD 34-ton tandem axle rear-dump Euclid featured at the 1949 Mining Congress Exposition in Cleveland, Ohio, is powered by two 190 hp. General Motors diesel engine-torque converter units each driving one rear axle which eliminates the conventional inter-axle power divider. A three speed Torqmatic transmission manufactured by the Allison Division of General Motors does away with clutch pedal or manual shifting of gears—operator can change to proper gear under full power and at any travel speed.

The compact General Motors Torque Converters, designed specifically for the GM diesel engines, multiply the starting torque in 3.6 to 1 ratio and together with the three-speed Torqmatic transmission afford tremendous power for starting a load or for pulling capacity loads up steep grade or over rough going. With standard gear ratios, top speed with full payload is 25.4 miles per hour.

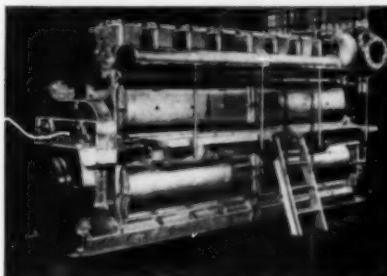
### New Oil-Filtering Material

A NEW, high-efficiency filtering material developed during the war is now commercially available. Hiltex is a combed, high-grade cotton with fine Sequoia bark fibers — resulting in a material of uniform density which is easily handled and evenly packed into filter cartridges.



Light weight permits use of less materials per cartridge filling, but at the same time gives more dirt storage capacity than conventional cotton waste threads. Hiltex is supplied in 2½ pound batts, and operators find it easy to pack correct amount in filter cartridges, as shown by the photograph. Because it is a cellulose product, Hiltex is suitable and approved for filtering of mineral, heavy-duty, additive and detergent type oils. For samples and further information, write to The Hilliard Corporation, Hiltex Dept., Elmira, New York.

## The ALCO PLAN for DIESEL ECONOMY



### FLEXIBILITY AND LOW COST OFFERED BY ALCO STANDARDIZED ENGINE

The ALCO plan helps Diesel plants where flexibility, economy, dependability, and provision for future growth are important. In one size of stationary Diesel engine, ALCO offers unusual advantages where multiples of 540 to 1,300 hp. can be used.

**LOW COST...** This basic design, also used in ALCO switch engines, is quantity-produced to make both first cost and the cost of replacement parts unusually low.

**FLEXIBILITY...** You can fit fluctuating load curves more closely than with fewer engines of larger size, or of varied capacity.

**LESS WEAR...** This more efficient use of engines means less wear per installed horsepower. The unused capacity of operating engines at any time need not exceed the capacity of one engine. There is no wear on the idle engines. Larger engines would necessitate greater wear per installed horsepower, with resulting higher costs.

**GREATER EFFICIENCY...** With engines operating near rated load, fuel consumption is less and operating conditions are better.

**UNIFORM ENGINE WEAR...** With several units of the same size, engines can be operated in rotation, allowing planned inspection and maintenance with minimum "down time."

**STAND-BY ECONOMY...** When all units are the same size, stand-by capacity can be limited to one size of engine the same as all others. With a variety of engine sizes, stand-by capacity might easily have to equal the largest single unit.

**SIMPLIFIED MAINTENANCE...** Uniform engine size means uniformity of replacement parts and of maintenance procedures; smaller stocks of parts; minimum of special tools; shorter "down time."

**EASY GROWTH...** As demand increases, gradual growth can take place by adding extra units of the same size.

## ALCO STANDARDIZED DIESEL ENGINES

### FREE BOOKLET GIVES DETAILS!

AMERICAN LOCOMOTIVE COMPANY  
Dept. D-6, 30 Church Street,  
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Please send me your illustrated brochure  
on ALCO Standardized Diesel Engines.

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

Zone \_\_\_\_\_ State \_\_\_\_\_



## Small Towboat Conversion



**A** FORMER U. S. Navy Sea Mule, now the *Sheryl L*, has been successfully converted to a river tow boat by Luhr Brothers, river contractors of Columbia, Illinois.

Principal alterations in construction included an 8 foot hull extension at the bow and the installation of towing knees for barge towing assignments. The additional hull section gives the boat an overall length of 43.65 feet. She has a 15 foot beam measurement and depth of 6.7 feet.

Sporting a pair of 6 cylinder General Motors Series 71 Diesel engines in place of the original power plants, the *Sheryl L* attains speeds of 5 mph upstream and 12 mph downstream. The drive to twin 44" x 36" propellers is through 4.5 to 1 reduction gears. Each engine is equipped with General Motors hydraulically operated reverse gears for ease of operation and close maneuvering ability. Adel combination throttle and clutch controls have been installed in the pilot house.

A complete galley and comfortable sleeping accommodations for a crew of three are located in the deck house.

Luhr Brothers have assigned a 38 x 120 foot barge to the *Sheryl L* and it is by this means that they transport much of their heavy equipment and supplies for river contracting jobs. Most of the runs are to Mississippi and Missouri River, points within short distances of St. Louis.

## A. J. Loose Elected Vice President & Treasurer of Texsteam Corp.



**A. J. Loose** corporation and will be in active charge of operations. Until recently Mr. Loose was associated with Vapor's Chicago plant, working on engineering and production of steam generators for the past eleven years.

**VAPOR** Heating Corporation, Chicago, the company that manufactures steam generators used to heat diesel powered trains, has acquired controlling interest in Texsteam Corporation, Houston, Texas.

A. J. Loose has been elected Vice President and Treasurer of Texsteam Corporation.

**The following are manufacturers whose engines are fully described with tabulated specifications:**

American Locomotive Company  
Atlas Imperial Diesel Engine Co.  
Baldwin Locomotive Works  
Buckeye Machine Co.  
The Buda Engine Co.  
Burmeister & Wain  
Caterpillar Tractor Co.  
Chicago Pneumatic Tool Co.  
Clark Brothers Co., Inc.  
Consolidated Diesel-Electric Corp.  
Continental Motors Corp.  
Cooper Bessemer Corp.  
Crofton Diesel Engine Co., Inc.  
Cummins Engine Co., Inc.  
Enterprise Engine & Foundry Co.  
Fairbanks, Morse & Co.  
Flagship Engine Co.  
Fulton Iron Works Co., Inc.  
General Motors Corp.  
Cleveland Diesel Eng. Div.  
Detroit Diesel Engine Div.  
Electro-Motive Div.  
Gray Marine Motor Co.  
Hallett Manufacturing Co.  
Harnischfeger Corp., P & H Diesel  
Hercules Motors Corp.  
Hill Diesel Engine Co.,  
Div. of Drake America Corp.  
Ingersoll-Rand Co.  
International Harvester Co.  
Kermath Manufacturing Co.  
The Lathrop Engine Co.  
Lima Hamilton Corp.  
Lister-Blackstone, Inc.  
Mack Manufacturing Corp.  
Mechanical Equipment Co.  
Murphy Diesel Co.  
National Supply Co.  
Nordberg Manufacturing Co.  
Palmer Brothers Engines, Inc.  
The Rathbun-Jones Engineering Co.  
John Reiner & Co., Inc.  
R. H. Sheppard Co.  
Stewart & Stevenson Services, Inc.  
Sun Shipbuilding & Drydock Co.  
The Union Diesel Engine Co.  
United States Motors Corp.  
Venn Severin Machine Co.  
Washington Iron Works  
Waukesha Motor Co.  
White-Roth Machine Co.  
Witte Engine Works  
Wolverine Motor Works, Inc.  
Worthing Pump & Machinery Corp.

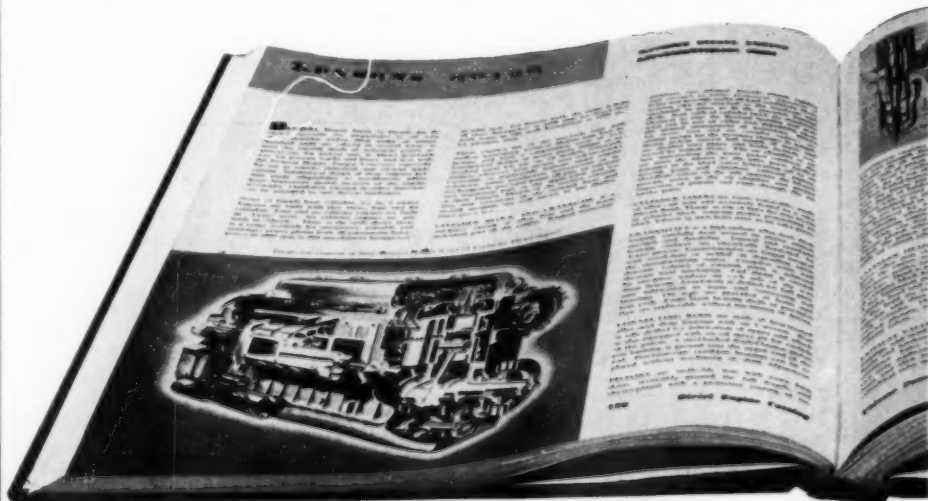


**no one connected with the diesel industry can afford to be without this book**

**A MUST for design and operating ENGINEERS!  
INDISPENSABLE for BUYERS!  
INVALUABLE to INSTRUCTORS & STUDENTS!**

IN NO OTHER BOOK can be found such complete and detailed information on diesel engines and accessories. Rewritten in its entirety while being brought up-to-date, great attention has been given to make Diesel Engine Catalog an easy-to-read book. Its unique chart showing Diesel Horsepower Ranges by manufacturer and its comprehensive classification and indexing, all contribute to making any item easy-to-find.

**Don't Have Obsolete Information in Your Technical or Purchasing Library!  
Make Sure the Information at Hand is Accurate and Up-to-Date!  
Every Edition a Sell-Out!**



### Largest Operator of Diesel Locomotives

All the principal passenger and freight trains east and west on the Pennsylvania Railroad are now operated by Diesel-electric or electric locomotives. The Pennsylvania is now the largest operator of Diesel-electric locomotives, as well as the largest user of steam and electric locomotives.

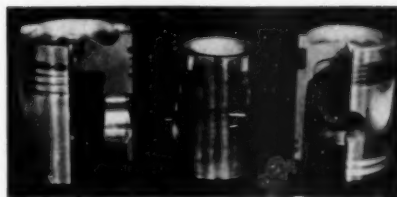
This announcement was made today in connection with completion of the railroad's postwar orders for 145 Diesel locomotives for road service. Already the Pennsylvania has put in service 430 Diesel-electric switching locomotives and 19 more are being built.

The last units in the railroad's fleet of powerful Diesel road locomotives, costing \$77,000,000, have just been delivered, rounding out that phase of the Pennsylvania's \$266,000,000 equipment modernization program. The remaining 19 switchers in the \$40,000,000 program for this type of locomotive, will be received from the builders in a few weeks.

The Pennsylvania is continuing its participation in joint research looking toward development of a coal-burning gas turbine locomotive, the successful conclusion of which may prove to be the next step in locomotive progress.

Sixty-three passenger and 82 freight road Diesels are operating on trains connecting Chicago, St. Louis, Cincinnati, Detroit, and Cleveland with eastern cities, as well as on some shorter runs.

### Fairchild Licenses Al-Fin Process To United Engine and Machine Co.



Cummins and Detroit diesel bi-metallic pistons and semi-machined Caterpillar bi-metallic piston.

**FAIRCHILD** Engine and Airplane Corporation has licensed the United Engine and Machine Company of San Leandro, California, to use the Al-Fin process in manufacturing bi-metallic pistons, it was announced by L. B. Richardson, president of Fairchild. This brings to six the number of Al-Fin licensees in the U. S. and abroad.

The Al-Fin process for molecular bonding of aluminum to steel will be used to reduce top ring groove wear in United's Silv-O-Lite aluminum alloy pistons. The bi-metallic construction lengthens piston life considerably by reducing ring land wear to a minimum. Silv-O-Lite pistons are sold throughout the country as original equipment and replacement parts for gasoline and diesel engines in trucks, buses, and tractors.

The United Engine and Machine Company, which manufactures aluminum alloy pistons exclusively, will supply replacement pistons, using the Al-Fin

process, for the following types of heavy-duty engines: Autocar, Buda, Caterpillar, Continental, Cummins, Detroit Diesel, GMC Diesel, Hall-Scott, Hercules, International, Mack, Twin Coach, Waukesha, and White.



Standard aluminum Cummins diesel piston showing failure of top ring groove alongside new bi-metallic replacement.

Extensive tests show that the bi-metallic assembly combines the advantages of the lightweight aluminum piston with the excellent wearing qualities of the cast iron ring carrier, offering exceptionally long life and virtually eliminating top ring breakage.

### Correction

In the detailed description of the municipal diesel plant at Goshen, Indiana, which appeared in our November issue, we sincerely regret that we failed to note that Burns & McDonnell, Consulting Engineers of Kansas City, supplied the engineering services in connection with the improvements described in that article.

**ENTIRELY REVISED AND REWRITTEN!**

# ENGINE CATALOG

**VOLUME 14**

**1949 EDITION**

**\$10**  
PER COPY

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- (b) An accessory section describing engine and plant accessories.
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- (d) A classified buyers' guide—"Market Place", covering Diesels, accessories, transmissions and other allied products.
- (e) A large advertising section. Manufacturers' advertisements carry a wealth of information for design and purchasing engineers.

**DIESEL HORSEPOWER RANGE CHART:** This catalog includes a new and startling chart showing horsepower ranges of diesel engines classified by manufacturer. By giving at a glance the range of horsepower ratings of the engines offered by each firm, it is a new and valuable aid to all connected with the Diesel Industry.

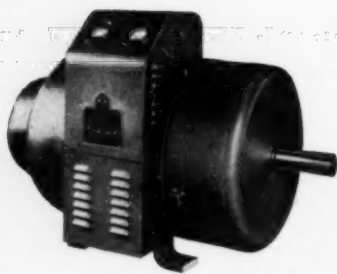
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## Formation of a New Corporation, Associated British Oil Engines, Inc.



Ronimund Bissing

THE FORMATION is announced recently of a new corporation, Associated British Oil Engines, Inc. which has been organized as a subsidiary of Associated British Oil Engines, Ltd., of England, the world's largest manufacturers of diesel engines outside of the United States.

Mr. Ronimund Bissing was elected President of the new corporation at the first meeting of the Board held at the offices of Ambritech (American British Technology, Inc.) until now Agents for the British company at 57 Park Avenue, New York.

The Directors of the new corporation are: Mr. Ronimund Bissing, formerly Vice President of Ambritech; The Hon. A. C. Geddes, Managing Director of Associated British Oil Engines, Ltd., of England; Mr. Brock Park, former Chairman of International Underwriters Corp.; The Lord Pentland, Director, Ambritech (Chairman of the Board).

The task of the new Corporation is to set up a sales organization for distribution in the U. S. and for supply to American manufacturers who incorporate diesel engines in their equipment for the export market. American manufacturers in incorporating these British engines will be able to offer their equipment to dollar scarce markets with payment for the engines to be made in sterling.

The group has a range of engines from 3 h.p. to 1800 h.p. including the "Cub", "McLaren", "Henry Meadows", "Mirrless", "Petter" and "Petter-Fielding". They started building engines in 1897 and are the second oldest manufacturers in the world. They have been marketed throughout the world over the last fifty years and the group have agents in over eighty different countries.

Hitherto the group has not exported to the U. S. Plans have been drawn up over the last two years by Ambritech to enter this market and devaluation of the pound sterling has now put the company in a strong competitive position.

### New Chain Catalog

MORSE CHAIN CO., Division of Borg-Warner Corp., is now offering a new 16-page catalog on flexible chain couplings. Subjects covered are: Roller chain stock couplings; silent chain stock couplings; heavy duty, made-to-order silent chain couplings, and steel and plastic covers for the two stock couplings. Complete information is given on dimension data, horsepower ratings, stock and maximum bores with many illustrations and useful descriptive matter. For a copy of the catalog C45-49, write Morse Chain Co., 7601 Central, Detroit 8, Mich.

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## Long Island Railroad Goes Diesel



Five new 660 hp. Alco diesel locomotives delivered to Long Island Railroad.

NEW Diesel-electric locomotives have now replaced all Long Island Rail Road steam engines in freight service within the City of New York it was announced by Horace B. Stetson, superintendent.

"The Long Island now has 35 Diesels in operation in Brooklyn and Queens, replacing all 54 steam locomotives formerly operated in freight service within the Metropolitan Area," Mr. Stetson said. "This means that the freight yards at Long Island City, Fresh Pond and Bushwick have been completely converted to Diesel operation. All steam engines at Holban Yard, Jamaica, have been replaced by Diesels except for those still used to haul a very few freight trains operating between Holban Yard and outlying points on the Island.

"Nineteen of the Diesels now in operation are of 600 horsepower and 16 are of 1,000 horsepower. Eleven more 660-horsepower Diesels are on order for delivery by September, and as these are received they will be used to release 1,000-horsepower diesels now in yard service for use in long-distance road freight service. When all 46 Diesels have been received, only two freight trains per day will be operated with steam engines out of Holban Yard."

The Long Island also has been experimenting with Diesel engines in passenger service on Saturday nights and Sundays, when freight service is light and passenger service on non-electrified lines is heavy.

Purchase of the 35 Diesels now in use and the 11 soon to be delivered was undertaken as the principal phase of the Long Island Rail Road's intensive program to reduce smoke from its operations within the Metropolitan Area to an absolute minimum. Under this program, all of the railroad's remaining steam locomotives have been equipped with the most modern efficient devices to abate smoke.

## New Trade Literature

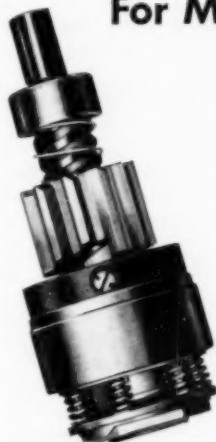
**DIAMOND** conveyor chains and sprockets are fully illustrated and described in a new 28-page Bulletin No. 29 just released for distribution by the maker, Diamond Chain Company, Inc., Indianapolis 7, Indiana. The chains are made in pitches ranging from 1 in. to 4 in. with standard and large rollers. Standard attachment links, extended pins, stainless steel, bronze and top plate chains along with appropriate sprockets are also described.

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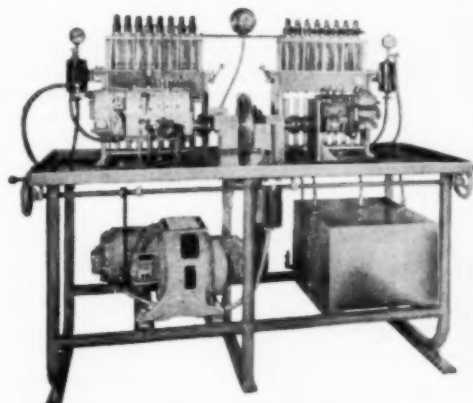
There are several definite factors responsible for Bendix\* Starter Drive economy: Its simple design lets you mount the starting motor more easily and in more positions. It requires no actuating linkage—has fewer parts—needs fewer adjustments. The solenoid may be mounted in any convenient position. No other starter drive made can match these economy advantages! So whatever your type of Diesel, specify Bendix Starter Drive for economy and all-around performance.

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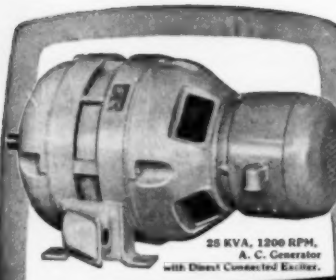
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### West Coast Diesel News

by FRED M. BURT

**THE** new 64' seiner, built at Harbor Boatyards, Vancouver, B. C. for Geo. T. Brajcich, powered with a 150-hp Caterpillar diesel is named *Freeland*; Brajcich, born in Poland, coming to West Coast 25 years ago, said, "I chose the name *Freeland* because I am proud of my country."

**THE** 135' steel tuna vessel, *Santa Helena*, is being converted into a live-bait boat at the Tacoma Boatbuilding Co., under supervision of Chief Eng. Tony Jelusich; conversion includes 3 Fairbanks-Morse vertical bait pumps driven by 20-hp F-M motors; vessel is powered with 1050-hp Enterprise main diesel; twin 235-hp Atlas diesel auxiliaries.

**SUPPLIED** to Stovepipe Wells (Calif.) Hotel for main lighting plant, by Generator Equipment Co., Los Angeles: Model 190-DLB, 52-hp Waukesha diesel-generating set with Kurtz & Root, 25-kva at 1200-rpm generator.

**FISHING** vessel *Sweet Elva*, owned by Alaska gill-netter John Berglund, has recently been equipped with Freon refrigeration, capacity to chill 20 tons of fish, plant driven with new 10-hp Buda diesel.

**CUMMINS** diesel-powered truck or tractor units delivered in September, as per information from Cummins Sales & Service, Los Angeles, 150-hp to 275-hp units; Autocars 6, Mack 1, Kenworth 1, Peterbilt 1; supplied for re-powering trucks Model HRB-6, NHB-1, HRBS-2, and NHBS-1, total of 12 trucks and 10 engines for re-powering.

**THE** new 54', custom-built cruiser *Saluda II* with a standard Trimmership hull, from plant of Shain Mfg. Co., Seattle, built for Earl F. Wilder, Olympia, Wash. is powered with twin 200-hp Gray-General Motors diesels, reconditioned by Evans Engine & Equip. Co., Seattle. A 5-kw Buda diesel-electric unit supplies auxiliary power.

**THE** General Motors Mobile Training unit stationed at Anderson-O'Brien Co., Los Angeles, (GM diesel distributors, So. Calif.) for three weeks in October, giving instructions on GM diesel operation, maintenance and repair, was attended by representatives sent by nearly 50 companies—major oil, end product manufacturers (drilling equipment etc.) all major movie studios, general contractors; having largest attendance of any instruction location, since leaving factory four months previously.

**HUDSON's** Bay Company's new, 149', wooden vessel, *Fort Hearne*, outfitted in Vancouver, B. C. for her initial trip, and future work between the Mackenzie and Cambridge Bay, is powered with an 8-cyl. 500-hp Fairbanks-Morse diesel engine.

**COMPLETELY** reconditioned and re-powered with a 320-hp Atlas Imperial diesel engine, 85' *Despatcher*, is latest addition to 13 vessel fleet of Island Tug & Barge Co., Victoria, B. C. Captain Andrew "Mickey" MacPherson will be in command.

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**NEW** all-steel towboat, 45' Wita, from David Scott Boatyards, Mitchell Island, B. C., for Bal-four, Guthrie & Co., has power plant of 165-hp Gray diesel, to give average cruising speed of 12 knots, traveling light, at 1200-rpm.

**A NEW** "Limit Boat" seiner from design of Ben Seaborn, Seattle naval architect, will have overall length of 57', hold capacity 1225 cu ft, long cruising range from total tankage of 2400-gal. and powered with D13000, 6 cyl, Caterpillar diesel to give 10-knot service speed through 2:1 reduction gears.

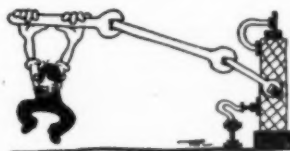
**GIVEN** to the San Pedro (Calif.) Sea Scouts by the Navy, the 40' Gallant, formerly an admiral's barge, is powered with a 225-hp Graymarine diesel; Skipper is Wm. McKenna, patrolman of San Pedro.

**TWO** HD-19, Allis-Chalmers tractors, powered with 165-hp GM diesels, with Twin Disc Torque Converters, were supplied by Shaw Sales & Service, Los Angeles, to H. B. Adair Construction Co., Gardena, for use on the Los Angeles River Flood Control project; two similar units owned by Los Angeles Co. are also on the same job.

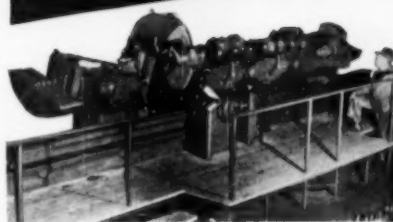
**SOLD** and installed by Bellingham (Wash.) Marine Supply Co., new-model 150-hp Gray diesel with 3:1 reduction gear, in seiner Gail, owned by Capt. Bob Largaud of Point Roberts.

**AFTER** two year's of spare-time work, tug boat Captain Earl Hopkins, Richmond, Calif. with his wife's help, starting with a Navy motor sailer hull, have completed 36' fishing boat, Evelyn H., gross tonnage, 10-tons; powered with a 4-cyl. 50-hp. Waukesha-Hesselman diesel.

Diesel Engine Catalog is just off the press in its Fourteenth Edition. See the unique Diesel Horsepower Range Chart — invaluable aid to design engineers and buyers. ORDER COUPON ON PAGE 67.



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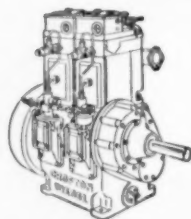
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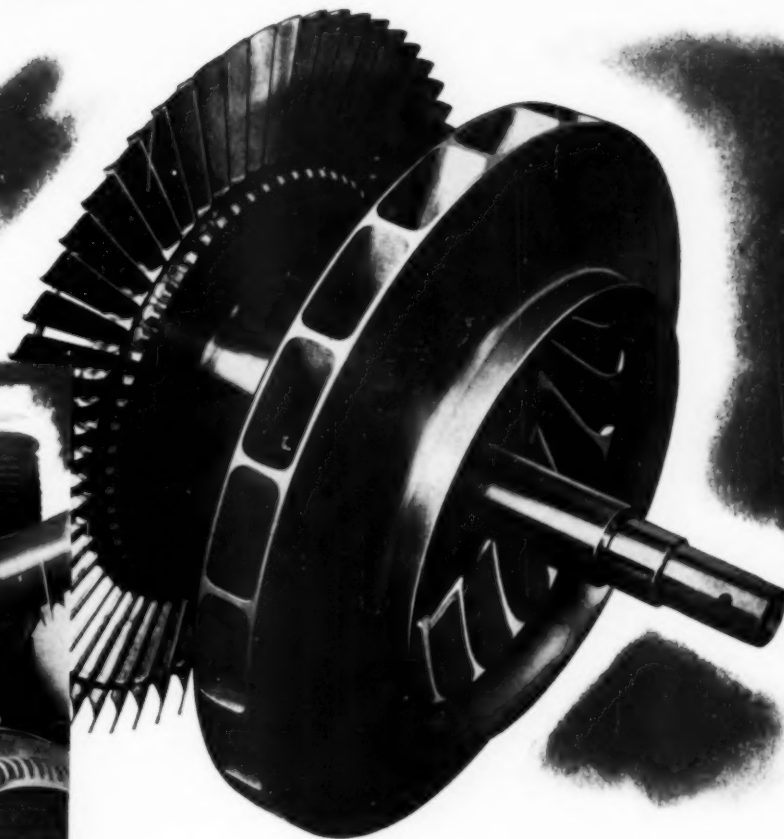
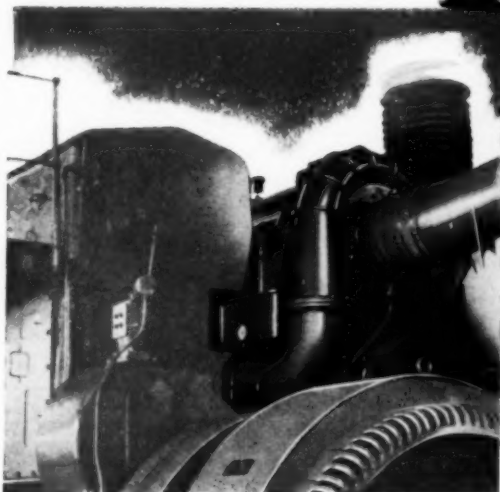
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For instance, the rotor, fast-turning heart of the turbocharger, is well designed and built for enduring service under tough operating conditions. The exhaust gases which power the turbine wheel are hot—up to 1020F, but high-strength, heat-resistant alloy steel blades and disc handle them. There's a big temperature drop to be taken care of in a few inches between the turbine wheel and the cast aluminum impeller wheel. The whole rotor, which in service revolves at speeds up to 21,000 rpm, is first of all precisely built, then tested by overspeeding, and then carefully balanced, both statically and dynamically. Would you like the details?



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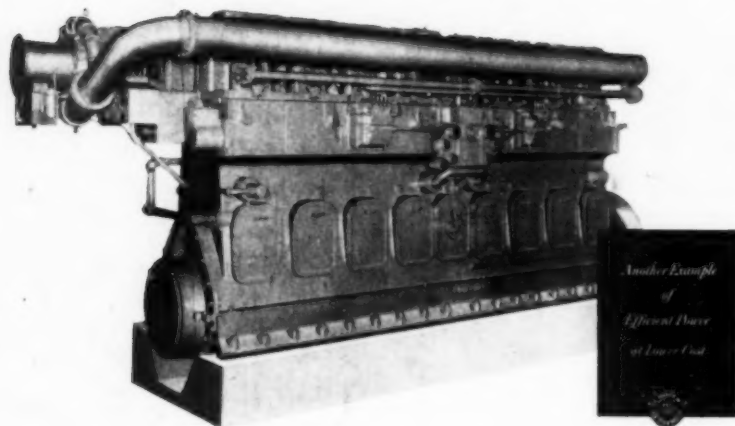
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Manufacturers of electric generators and motors, turbochargers for four-cycle Diesel engines, scavenging blowers and twin oil engines.

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*100% gas fuel operation!*



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Like ordinary gas engines, Cooper-Bessemer supercharged 4-cycle gas engines are spark-ignited, requiring no pilot oil charge. However, they offer at least 50% higher thermal efficiency, consuming less than 7,000 BTU per horsepower hour — easily a 30% saving in fuel.

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psi, the new supercharged engines produce 80% more horsepower. Thus any power need can be met with fewer or smaller engines, permitting additional big savings in installation, housing, piping, maintenance and normal operating overhead.

For further data, for specific information on what this new development offers in meeting your particular needs, check with the nearest Cooper-Bessemer office.

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